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An Evaluation of the Harvest Distribution, Survival and Exploitation Rate of Selected Wild Coho Salmon Stocks of the Lower Fraser River Area

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by

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ABSTRACT

Schubert, N.D. and M.R. Zallen. 1990. An evaluation of the harvest distribution, survival and exploitation rate of selected wild coho salmon stocks of the lower Fraser River area. Can. MS Rep. Fish. Aquat. Sci. 2052: 97 p.

Coded wire tags were applied to wild coho salmon (**Oncorhynchus kisutch**) stock in the Vedder-Chilliwack, upper Chilliwack, Salmon, upper Pitt, Birkenhead and Campbell rivers and Salwein Creek from 1976 to 1982. Harvest was assessed through the coast-wide mark recovery program, and escapement was assessed through field studies.

The majority of study stock harvest occurred in southern British Columbia waters, with an average of less than 8% occurring north of Vancouver Island and south of Juan de Fuca Strait. Within this area, there was considerable variability in the proportion of harvest inside and outside the Strait of Georgia. In many cases, the estimation of total survival and exploitation rate was inhibited by the quality of escapement and terminal harvest estimates. Of the stocks with reliable data, all but one were overharvested in the early 1980's.

Vedder-Chilliwack coho had an inside harvest distribution. Survival from smolt to harvest and in total averaged 19.0% and 24.1%, the highest among the study stocks. Exploitation rate averaged 78.6%; however, estimate reliability was limited by uncertainty in the escapement and terminal harvest data.

Upper Chilliwack coho had a variable harvest distribution, with both inside and outside distributions over the study period. Survival from age 0+ fry to harvest and in total averaged 3.8% and 4.7%. Exploitation rate averaged 82.9%; however, estimate reliability was limited by uncertainty in the escapement and terminal harvest data.

Salmon coho had an inside harvest distribution. Survival from smolt to harvest and in total averaged 9.7% and 15.2%. Exploitation rate averaged 64.5%; however, estimate reliability was limited by uncertainty in the escapement data.

Upper Pitt coho had an outside harvest distribution. Survival from age 0+ fry to harvest and in total averaged 2.6% and 3.2%. Survival from age 1+ fry to harvest and in total averaged 4.2% and 5.9%. Exploitation rate averaged 80.1%.

Birkenhead coho had an outside harvest distribution. Survival from age 0+ fry to harvest and in total averaged 2.9% and 3.7%. Exploitation rate averaged 77.5%, and was probably underestimated.

Campbell coho had an outside harvest distribution. Survival from smolt to harvest and in total was 10.2% and 16.3%. Exploitation rate was 62.6%, and was probably overestimated.

Salwein coho had an inside harvest distribution. Survival from smolt to

harvest and in total was 11.6% and 15.9%. Exploitation rate was 72.6%.

Key words: lower Fraser River, coho salmon, harvest distribution, survival to harvest, total survival, exploitation rate.

RÉSUMÉ

Schubert, N.D. and M.R. Zallen. 1990. An evaluation of the harvest distribution, survival and exploitation rate of selected wild coho salmon stocks of the lower Fraser River area. Can. MS Rep. Fish. Aquat. Sci. 2052: 97 p.

De 1976 à 1982, des étiquettes métalliques codées ont été fixées à un stock de saumons cohos sauvages (**Oncorhynchus kitsutch**) fréquentant la rivière Vedder-Chilliwack, le cours supérieur de la Chilliwack, la rivière Salmon, le cours supérieur de la rivière Pitt, les rivières Birkenhead et Campbell et le ruisseau Salwein. Les captures ont été évaluées par le biais du programme de récupération des marques s'étendant à toute la côte, et l'échappée par des études sur le terrain.

La majorité des captures du stock à l'étude ont été effectuées dans les eaux du sud de la Colombie-Britannique, avec une moyenne de moins de 8% au nord de l'île de Vancouver et au sud du détroit Juan de Fuca. Dans cette zone, la proportion des prises effectuées à l'intérieur et à l'extérieur du détroit de Géorgie présentait une grande variabilité. Dans bon nombre de cas, l'estimation de la survie totale et du taux d'exploitation a été entravée par la qualité des estimations de l'échappée et des captures en estuaire. De tous les stocks pour lesquels nous possédions des données fiables, tous sauf un ont fait l'objet d'une surexploitation au début des années 1980.

Dans le cas du coho de la Vedder-Chilliwack, on a relevé l'existence d'une répartition des captures à l'intérieur du détroit. Le taux de survie depuis l'état de smolt jusqu'à la capture et le taux de survie totale s'établissaient en moyenne à 19,0% et à 24,1% le taux le plus élevé ayant été enregistré parmi les stocks à l'étude. Le taux d'exploitation s'établissait en moyenne à 78,6%; toutefois, l'incertitude des données sur l'échappée et les prises en estuaire a limité la fiabilité des estimations.

La répartition des prises de cohos dans le cours supérieur de la Chilliwack était variable, avec des répartitions à l'intérieur et à l'extérieur couvrant la période à l'étude. Le taux de survie depuis l'alevin 0+ jusqu'à la capture et le taux de survie totale s'établissaient en moyenne à 3,8% et à 4,7%. Le taux d'exploitation s'établissait en moyenne à 82,9%; toutefois, l'incertitude des données sur l'échappée et les prises en estuaire a limité la fiabilité des estimations.

Le saumon coho de la riviére Salmon présentait une répartition des prises à l'intérieur du détroit. Le taux de survie depuis l'état de smolt jusqu'à la capture et le taux de survie totale s'établissaient en moyenne à 9,7% et à 15,2%. Le taux d'exploitation s'établissait en moyenne à 64,5%; toutefois, l'incertitude des données sur l'échappée a limité la fiabilité des estimations.

Le coho du cours supérieur de la rivière Pitt présentait une répartition des prises à l'extérieur du détroit. Le taux de survie depuis l'alevin d'âge 0+ jusqu'à la capture et le taux de survie totale s'établissaient en moyenne à 2,6% et à 3,2%. Le taux de survie de l'alevin d'âge 1+ jusqu'à la capture et

le taux de survie totale s'établissaient en moyenne à 4,2% et à 5,9%. Le taux d'exploitation était en moyenne de 80,1%.

Le coho de la Birkenhead présentait une répartition des prises à l'extérieur du détroit. Le taux de survie depuis l'alevin d'âge 0+ jusqu'à la capture et le taux de survie totale s'établissaient en moyenne à 2,9% et à 3,7%. Le taux d'exploitation s'établissait en moyenne à 77,5% et il a sans doute été sous-estimé.

Le coho de la rivière Campbell présentait une répartition des prises à l'extérieur du détroit. Le taux de survie depuis le smolt jusqu'à la capture et le taux de survie totale étaient de 10,2% et de 16,3%. Le taux d'exploitation était de 62,6%, et il a probablement été sous-estimé.

Le coho de la rivière Salwein présentait une répartition des prises à l'intérieur du détroit. Le taux de survie depuis l'état de smolt jusqu'à la capture et le taux de survie totale étaient de 11,6% et de 15,9%. Le taux d'exploitation était de 72.6%.

Mots-clés: cours inférieur du Fraser, saumon coho, étiquette métallique codée, répartition des prises, survie jusqu'à la capture, survie totale, taux d'exploitation.

INTRODUCTION

The coho salmon (**Oncorhynchus kisutch**) originating in Fraser River tributary streams below Hope (Fig. 1) are a major component of the Fraser River coho resource. Escapements to the lower Fraser River area in the 1970's averaged 75% of the system total (Farwell **et al.** 1987). Coded wire tagging studies have been conducted on selected wild stocks in this area since 1976 to provide basic assessment information. The purpose of these studies was to document the harvest distribution, survival and exploitation rate of these stocks.

Previous reports have documented the juvenile capture and coded wire tag (CWT) application (Fedorenko and Cook 1982; Schubert 1982, 1983, 1984; Schubert and Fedorenko 1985; Schubert **et al.** 1985) and adult escapement estimation (Schubert **et al.** 1985; Schubert and Fleming 1989) components of studies in the Birkenhead, Campbell, upper Chilliwack, upper Pitt, Salmon and Vedder-Chilliwack rivers and Salwein Creek (Fig. 1). This report analyzes results from these studies in conjunction with harvest information from the coast-wide mark recovery program to provide estimates of harvest distribution, survival and exploitation rate for those stocks. The report also presents statistical comparisons of the above parameters between stocks. The report was not intended to provide a comprehensive assessment of the study stocks; rather, it provides a single source of information from which future assessments could be made.

STUDY BACKGROUND

GENERAL

The CWT studies documented in this report were implemented in the absence of comprehensive management or enhancement plans for lower Fraser River coho salmon. In general, the studies were opportunistic and study design often reflected logistic or funding considerations rather than data requirements. There were three consequences. First, the reliability of escapement estimates often varied between stocks and within stocks over the study period. While survivals and exploitation rates were reported for all stocks, these parameters may not be comparable between stocks in all years . Second, because CWTs were applied to emigrant smolts (Vedder-Chilliwack, Salmon and Campbell rivers) and to rearing fry (upper Chilliwack, upper Pitt and Birkenhead rivers), between stock comparisons were limited in two ways: a) survival from release to harvest could not be compared between groups, and b) exploitation rate estimates were not comparable between techniques for stocks which matured at both age 3_2 and 4_3 When tagged as rearing juveniles, exploitation rate could be calculated for the entire brood over two harvest years (ages 3_2 and 4_3); however, the estimate incorporated error from age misidentification at release. When tagged as emigrant smolts, an annual exploitation rate could be calculated because marine residency of southern B.C. coho is thought to be fixed at about 18 months (recruitment at the end of the first summer followed by the year of major harvest); however, because the smolt emigration included parts of two brood years, brood year specific exploitation rates could not be calculated. Third, the studies tended to be implemented consecutively rather than concurrently; therefore, the opportunity for within year statistical comparisons between stocks was limited.

Basic study design and sources of CWT application and adult escapement data are described by study area below. Specific aspects of each study are summarized in Table 1.

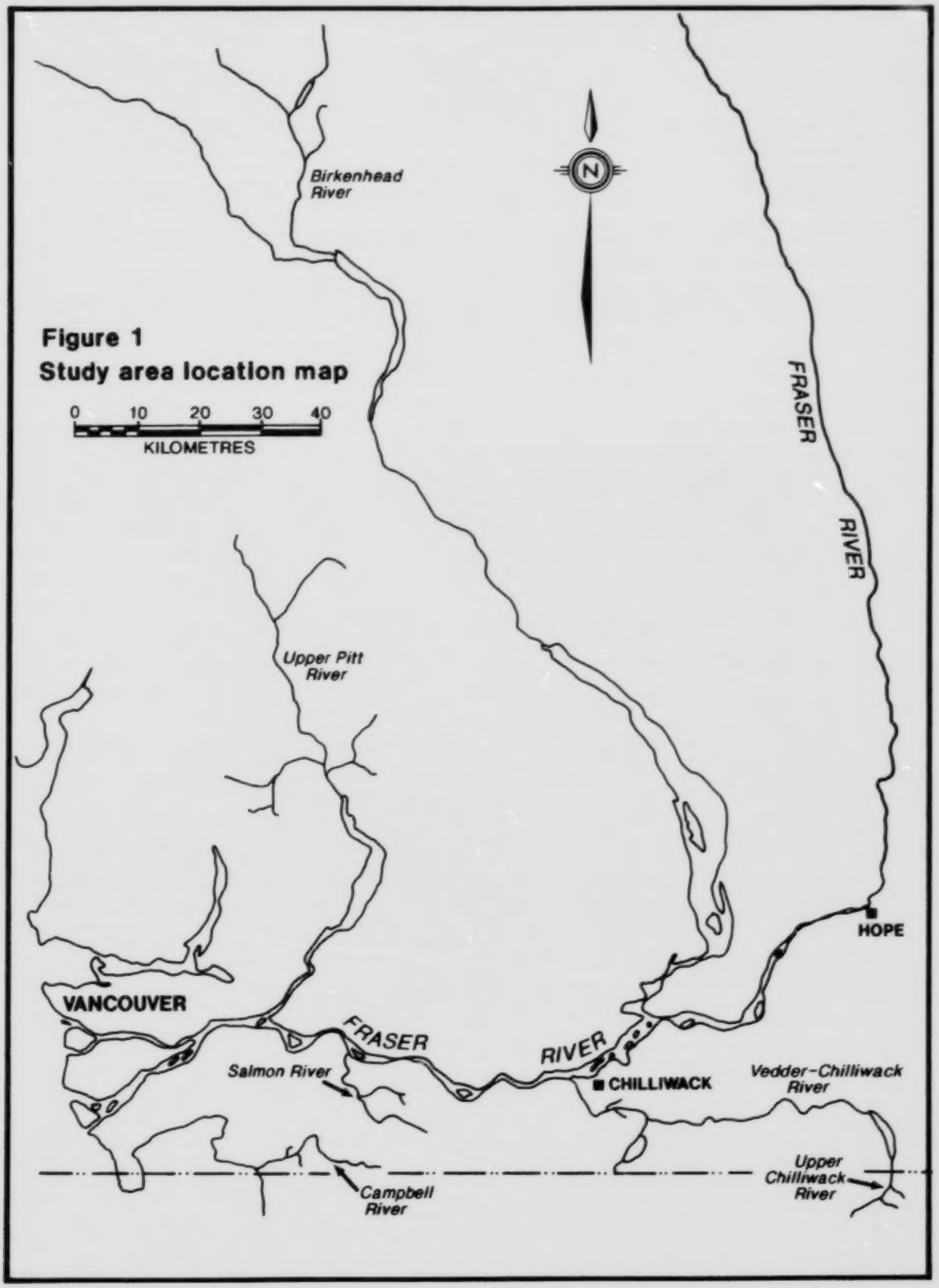

Figure 1
Study area location map

Table 1. Summary of release, harvest and escapement assessment periods by stock, coded wire tag code and brood year.

System	Dominant brood year	CWT release Year	Season	Dominant age	CWT code	Harvest period Observed range	Dominant year	Observed escapement year
Vedder-Chilliwack River	1974	1976	Spring	1+	02 15 13	1977-78	1977	1977
	1975	1977	Spring	1+	02 04 13	1977-79	1978	1978
	1976	1978	Spring	1+	02 21 24	1978-80	1979	1979
Upper Chilliwack River	1975	1976	Autumn	0+	02 15 11	1978-79	1978	1978
	1976	1977	Autumn	0+	02 21 20	1979	1979	1979
	1977	1978	Autumn	0+	02 21 30	1979-80	1980	1980
	1978	1979	Autumn	0+	02 17 60	1981-82	1981	1981
Salmon River	1976	1978	Spring	1+	02 16 52	1978-79	1979	1979
	1977	1979	Spring	1+	02 16 59	1979-81	1980	1980
	1978	1980	Spring	1+	02 18 23	1980-82	1981	1981
Upper Pitt River	1977	1979	Autumn	1+	02 16 60	1981-82	1981	1981
	1978	1979	Autumn	0+	02 16 62	1980-82	1981	1981-82
	1978	1980	Autumn	1+	02 18 02	1982	1982	1982
	1979	1980	Autumn	0+	02 18 03	1981-84	1982	1982-83
Campbell River	1980	1982	Spring	1+	02 22 62	1982-83	1983	1983
Birkenhead River	1980	1982	Autumn	1+	02 23 26	1984	1984	1984
	1981	1982	Autumn	0+	02 22 09	1984-85	1984	1984
Salwein Creek [a]	1980	1982	Spring	1+	02 21 15	1982-84	1983	1983

[a] Study data reported by Schubert and Lister (1986).

VEDDER-CHILLIWACK RIVER

The Vedder-Chilliwack River, the largest in the study area, arises at Chilliwack Lake and flows in a westerly direction for 61 km, entering the Sumas River and subsequently the Fraser River near Chilliwack, B.C. (Fig. 1). The juvenile and adult components of the Vedder-Chilliwack River CWT study were described by Fedorenko and Cook (1982) and Schubert and Fleming (1989), respectively. Coho smolts were released with CWTs in the springs of 1976 to 1978. Smolts were captured predominantly at age 1+ (range 93% to 98%) in fence traps in up to seven small streams tributary to the Vedder-Chilliwack River. The Vedder-Chilliwack stock, therefore, may represent a group of discrete smaller stocks. Vedder-Chilliwack coho matured predominantly at age 3_2 (95.4%). Adult escapement was estimated in the winters of 1977 to 1979 using a variety of methods

including fence counts, spawner curves, mark-recovery rates and visual techniques.

UPPER CHILLIWACK RIVER

The upper Chilliwack River arises in the Cascade Mountains of Washington State and flows in a northerly direction for 24 km, entering the south end of Chilliwack Lake (Fig. 1). The juvenile and adult components of the upper Chilliwack River CWT study were described by Fedorenko and Cook (1982) and Schubert and Fleming (1989), respectively. Coho fry were released with CWTs in the autumns of 1976 to 1979. Rearing fry were captured predominantly at age 0+ (range 89% to 99%) in minnow traps in Chilliwack Lake. All fry were coded wire tagged with the same code. Upper Chilliwack coho matured predominantly at age 3_2, although up to 12% returned at age 4_3. Adult escapement was estimated in the autumns of 1978 to 1981 using subjective visual techniques.

SALMON RIVER

The Salmon River is a small lowland stream which flows in a northwesterly direction for approximately 33 km, entering the Fraser River near Fort Langley (Fig. 1). The juvenile and adult components of the Salmon River CWT study were described by Schubert (1982) and Schubert and Fleming (1989), respectively. Coho smolts were released with CWTs in the springs of 1978 to 1980. Smolts were captured predominately at age 1+ (range 93% to 98%) in fence traps in the Salmon River and Coghlan Creek, the principal tributary. The age at maturity of Salmon coho was variable, with the age 4_3 component ranging from 0% to 27% of the escapement. Adult escapement was estimated in the winters of 1979 to 1981 using a spawner curve technique modified to compensate for an inability to directly evaluate spawner residence time.

UPPER PITT RIVER

The upper Pitt River arises in the Coast Mountains and flows in a southerly direction for 52 km, entering the north end of Pitt Lake (Fig. 1). The juvenile and adult components of the upper Pitt River CWT study were described by Schubert and Fedorenko (1985) and Schubert and Fleming (1989). Coho fry were released with CWTs in the autumns of 1979 and 1980. Rearing fry were captured at age 0+ (range 80% to 82%) and age 1+ (range 18% to 20%) in minnow traps in up to ten major rearing areas. Each age class was coded wire tagged with a unique code; however, error in age discrimination was reported. The age at maturity of upper Pitt coho was variable, with the age 4_3 component ranging from 4% to 27% of the escapement. Adult escapement in the winters 1981 to 1983 was estimated from a spawner index calibrated to a base-year mark-recapture study.

BIRKENHEAD RIVER

The Birkenhead River arises in the Coast Mountains and flows in a southerly direction for 54 km, entering the upper end of Lillooet Lake (Fig. 1). The juvenile and adult components of the Birkenhead River CWT study were described by Schubert et al. (1985). Coho fry were released with CWTs in the autumn of 1982. Fry were captured predominantly at age 0+ (96%) in minnow traps throughout the Birkenhead River. Each age class was coded wire tagged with a unique code; however, considerable error was reported in field age identification. Birkenhead coho matured predominantly at age 3_2 (96%). Adult escapement was estimated in the winter of 1984 from a mark-recapture study. Escapement

of age 4_3 adults was not evaluated in 1985.

CAMPBELL RIVER

The Campbell River is a small lowland stream which flows in a westerly direction for approximately 26 km, entering Semiahmoo Bay 1.5 km north of the Canada-United States International Boundary (Fig. 1). The juvenile and adult components of the Campbell River CWT study were described by Schubert (1983) and Schubert and Fleming (1989), respectively. Coho smolts were released with CWTs in the spring of 1982. Smolts were captured almost entirely at age 0+ (99.9%) at a fence trap in the lower river. Adult escapement was estimated at a fence. Age at maturity information was unavailable.

SALWEIN CREEK

Salwein Creek is a small lowland stream which flows in a southwesterly direction for 3 km, entering the Vedder portion of the Vedder-Chilliwack River approximately 7 km upstream from the Fraser River (Fig. 1). The juvenile and adult components of the Salwein Creek CWT study were described by Schubert (1984) and Schubert and Fleming (1989), respectively. A description of the study design and analysis of results was reported by Schubert and Lister (1986). Coho smolts were released with CWTs in the spring of 1982. Smolts were captured predominantly at age 1+ (99%) at a fence trap in the lower river. Salwein coho matured almost entirely at age 3_2 (98%). Adult escapement was evaluated by a mark-recapture study in the winter of 1983.

METHODS

HARVEST SAMPLING

A coast-wide harvest sampling program, supported by government management agencies in British Columbia and the Pacific Coast states of Alaska, Washington, Oregon and California, was conducted throughout the study period to enable estimation of fishery contributions of coded wire tagged salmonid groups.

In British Columbia, commercial harvest statistics were compiled by the Department of Fisheries and Oceans for 32 statistical areas and 14 catch regions (statistical area aggregates) (Fig. 2). Since 1974, salmon landings by the commercial fishery were sampled for adipose fin clips with the objective of examining 20% of the harvest by gear type, week and statistical area (J.E. Sager & Associates MS 1985). The 20% harvest sampling level has been adopted by all agencies participating in the coast-wide mark recovery program. The fishery contribution of each CWT group was estimated, by area and time, from the number of observed recoveries and the estimated proportion of the harvest examined for marks.

Harvest estimates by CWT group were obtained by catch region, gear and month from the regional mark recovery program data base (Kuhn 1988). These data were then corrected for four sampling problems which were especially prevalent in the early years of the mark recovery program. First, observed recoveries were not expanded for time/area strata if the proportion of the catch sampled (C:S) was too small to provide reliable results. Because rigorous statistical procedures were unavailable, we arbitrarily rejected strata where the C:S exceeded 10.0 if the sample totalled less than 10,000 coho and five recoveries of the CWT group of interest. Second, some troll fisheries reported coho harvest before the opening of the coho season. These recoveries were assumed to have been misidentified in the field as chinook and were not expanded. Third, the troll fishery off the northwest coast

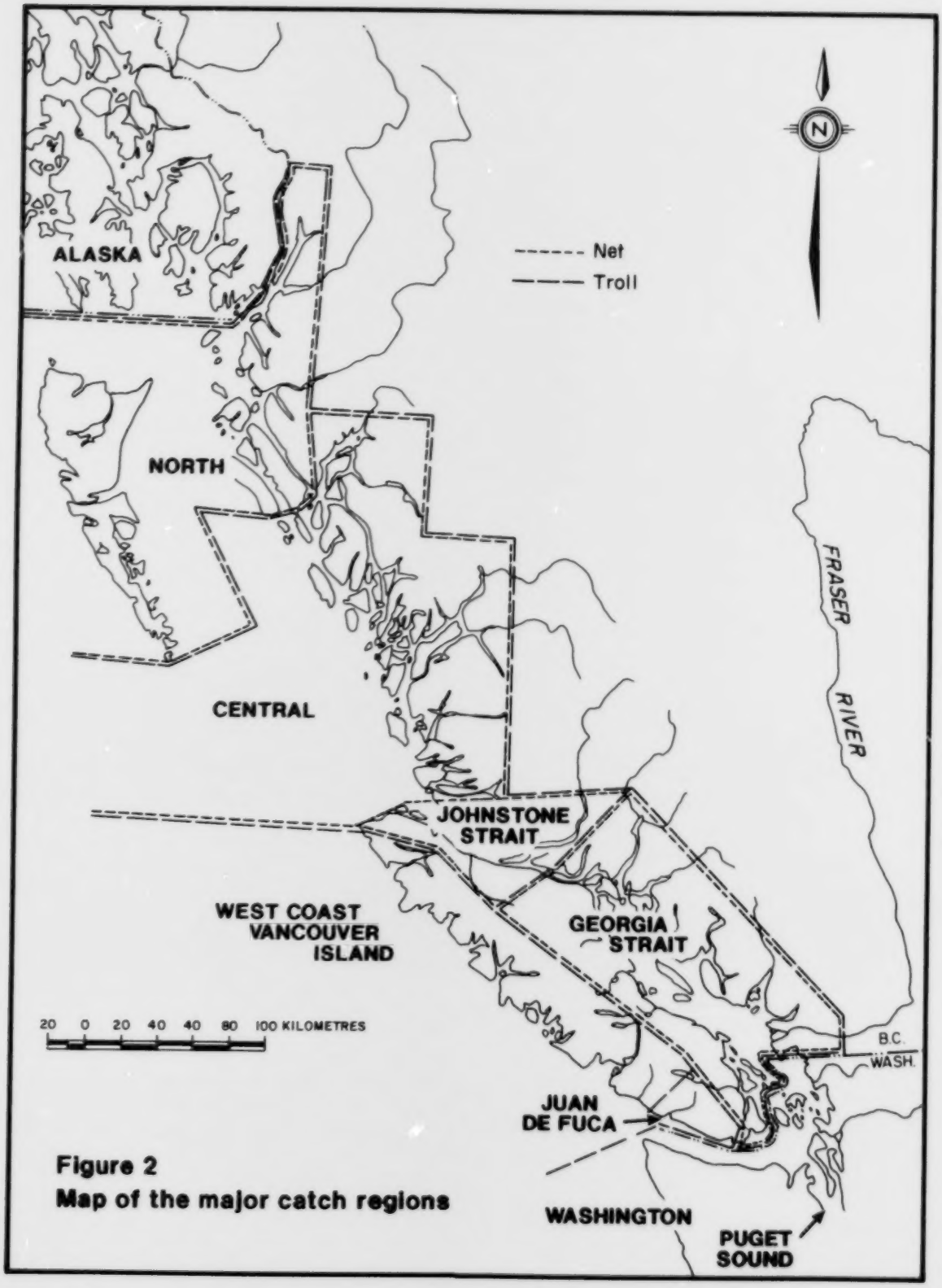

Figure 2
Map of the major catch regions

of Vancouver Island was undersampled through most of the 1970's. To avoid eliminating these data, we combined sample and harvest data from the southwest and northwest troll regions to generate a single estimate for the west coast of Vancouver Island troll. Fourth, some troll recoveries could not be isolated to a single catch region. In these cases, we combined the sample and harvest data for those regions in that week to compute a new C:S ratio for that recovery.

Mark recoveries in the British Columbia marine and fresh water sport fisheries were obtained on a voluntary basis from fishermen who returned the heads of adipose clipped fish to a network of head depots distributed throughout the province. Voluntary returns represented only a portion of the total number of sport caught tagged fish. In the Strait of Georgia, the reporting rate was determined from the estimated harvest of adipose clipped coho reported by a creel survey conducted since 1981 (Shardlow **et al.** 1985). For recoveries before 1981, we used the average reporting rate observed in the first two years of the creel survey. Reporting rate estimates were unavailable for other sport fisheries and were likely to differ from the Strait of Georgia. It was not possible, therefore, to expand observed recoveries in these fisheries.

Study area stocks were vulnerable to the native subsistence fisheries in the lower Fraser River and Lillooet River system. Harvest could not be estimated because the fishery was not sampled and voluntary head returns were unavailable.

DATA ANALYSIS

Analysis of the study data was complicated by a lack of established variance estimation techniques for CWT recoveries. Although theoretical methods have been developed (Webb 1986; Clark and Bernard 1987), none are in general use. Because sources of bias and variance accumulate with statistical manipulation (Hunter 1988), we concluded that it was inappropriate to statistically compare estimated CWT harvest. Instead, two levels of analysis were undertaken. Statistical tests of observed recoveries were used for within year, between stock comparisons. This avoided between stock differences in sampling bias because all CWT codes were exposed to identical sampling effort. Between year comparisons were limited to subjective evaluation of differences in estimated CWT recoveries.

Within Year Comparisons

Harvest Distribution: Harvest distributions in the marine fisheries were analyzed by G-tests of independence (Sokal and Rohlf 1981). The tests employed the actual number of CWT recoveries in each geographic area, not the estimated number which was based on expansion factors of varying magnitude. Catch data were grouped to ensure that at least 80% of the cells in area by stock comparisons had a frequency of five or more. Generally, area comparisons included north and central coast troll, west coast of Vancouver Island troll, Strait of Georgia troll, Strait of Georgia sport, British Columbia net, Puget Sound sport and net and Washington and Oregon sport and troll.

Geographic Distribution: Harvest in the hook and line fisheries was considered to best represent ocean distributions, especially distributional differences between the Strait of Georgia (inside) and outside waters. Distributions in the outside fisheries, the north and central coast troll, west coast of Vancouver Island troll, and Washington/Oregon troll fisheries, were first tested as above. These fisheries were then grouped and

Table 2. Estimated harvest of coded wire tagged Vedder-Chilliwack River system coho salmon in the major coastal fisheries.[a]

	Dominant brood year			
	1974	1975	1976	Average
North and central coast troll	7 0.2%	51 1.4%	154 2.6%	- 1.4%
West coast of Vancouver Island troll	835 22.7%	346 9.6%	776 13.3%	- 15.2%
Strait of Georgia troll	638 17.3%	1,238 34.5%	1,622 27.7%	- 26.5%
Strait of Georgia sport	884 24.0%	1,424 39.7%	2,568 43.9%	- 35.9%
British Columbia net	521 14.2%	169 4.7%	202 3.5%	- 7.4%
Puget Sound sport and net	467 12.7%	226 6.3%	263 4.5%	- 7.8%
Washington and Oregon sport and troll	328 8.9%	134 3.7%	196 3.3%	- 5.3%
Miscellaneous sport and troll	0 0.0%	0 0.0%	73 1.2%	- 0.4%
Total	3,680	3,588	5,854	-

[a] Includes all reported recoveries.

distributional differences between the aggregate outside and inside (Strait of Georgia sport and troll) fisheries were tested as above. Distributions were further analyzed by comparing harvest, as above, between the northern (Johnstone Strait) and southern (Juan de Fuca Strait, Area 4 and 5 portions of Puget Sound) approach net fisheries.

Seasonal Distribution: The seasonal distribution of CWT recoveries in the Strait of Georgia sport fishery was also examined by G-test in the same manner as the geographic distribution. Monthly recoveries were tested; however, in some cases it was necessary to group early or late season months to increase the number of observations in those cells.

Survival and Exploitaton Rate: Survival from release to observed harvest was compared by G-test. Statistical tests were not performed on survival to estimated harvest due to previously noted problems with

Table 3. Distribution of the estimated harvest of coded wire tagged Vedder-Chilliwack River coho salmon in the hook and line fisheries.[a]

	Dominant brood year		
	1974	1975	1976
Outside fisheries:			
North and central coast troll	7	51	154
	0.3%	1.6%	2.9%
West coast of Vancouver Island troll	835	346	776
	30.6%	10.9%	14.5%
Washington/Oregon sport and troll	328	134	192
	12.0%	4.2%	3.6%
Inside fisheries:			
Strait of Georgia sport and troll	1,518	2,622	4,100
	55.6%	82.8%	76.7%
Puget Sound sport	43	12	124
	1.6%	0.4%	2.3%
Outside fisheries	42.8%	16.8%	21.0%
Inside fisheries	57.2%	83.2%	79.0%
Total hook and line harvest	2,731	3,165	5,346

[a] Age 3_2 recoveries only.

variance estimation. Statistical tests were not performed on total survival and exploitation rate due to inadequacies in the escapement estimates.

Between Year Comparisons

Between year, within stock comparisons of geographic and seasonal harvest distributions, survivals and exploitation rates estimated from expanded CWT recoveries were treated subjectively. No statistical tests were performed.

RESULTS

VEDDER-CHILLIWACK RIVER

Harvest

The estimated annual harvest of coded wire tagged 1974-76 brood Vedder-Chilliwack coho ranged from 3,588 to 5,854 (Table 2; Appendix 1). Up to 2% of the harvest occurred in the year preceding or following the dominant year of harvest (Appendix 1). The former had recruited to the fisheries as early as June of their first

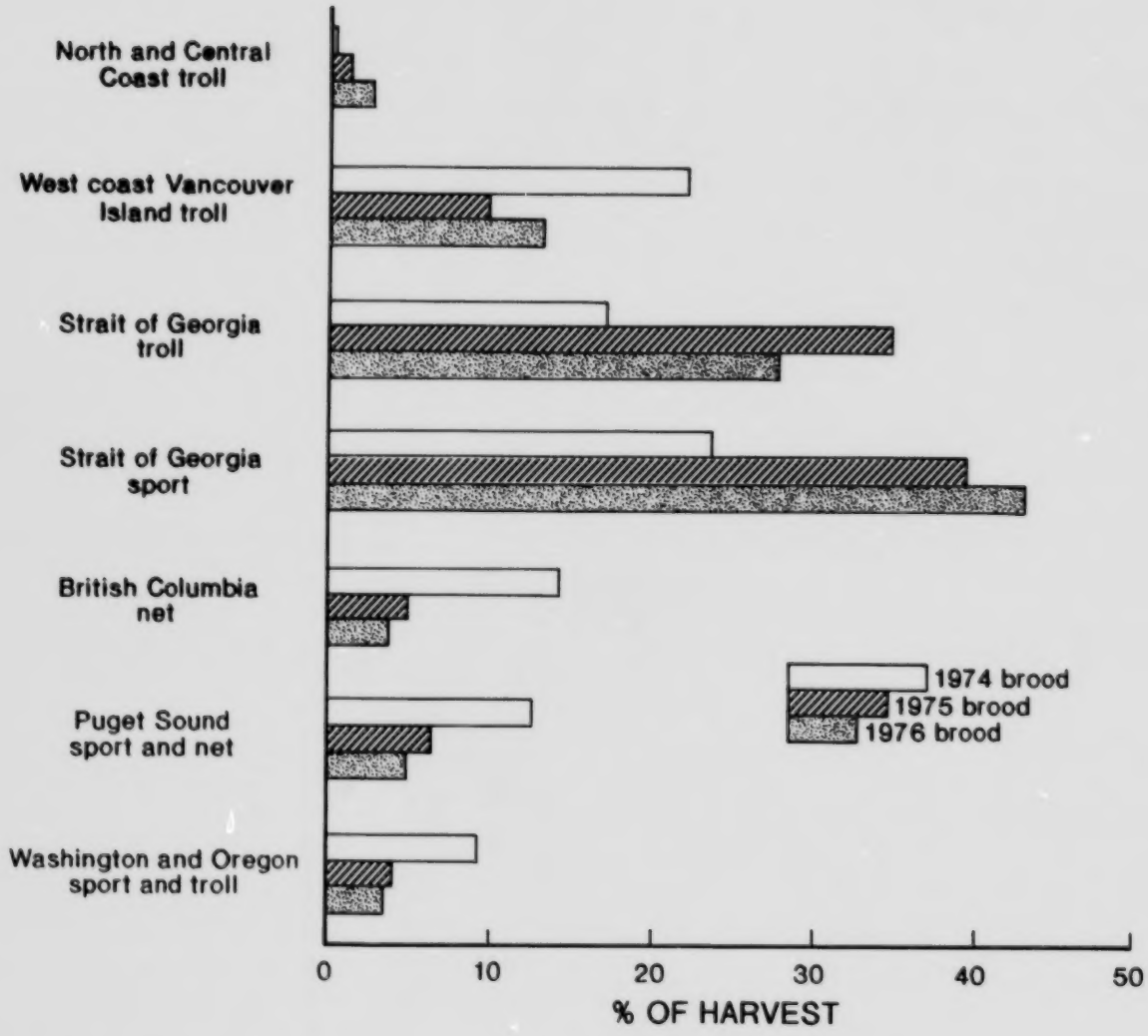

Figure 3 Distribution of the harvest of Vedder–Chilliwack River coho salmon among the major fisheries. Percentages are based on the estimated number of CWTs taken in each fishery in the dominant harvest year

Table 4. Seasonal distribution of the estimated harvest of coded wire tagged Vedder-Chilliwack River coho salmon in the hook and line fisheries. [a]

Dominant brood year	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov-Dec
Commercial troll fisheries									
1974	-	-	-	175	742	499	288	44	-
	0.0%	0.0%	0.0%	10.0%	42.4%	28.5%	16.5%	2.5%	0.0%
1975	-	-	-	312	931	235	247	-	-
	0.0%	0.0%	0.0%	18.1%	54.0%	13.6%	14.3%	0.0%	0.0%
1976	-	-	1	56	1,703	647	363	5	-
	0.0%	0.0%	0.0%	2.0%	61.4%	23.3%	13.1%	0.2%	0.0%
Mean:	0.0%	0.0%	0.0%	10.0%	52.6%	21.8%	14.6%	0.9%	0.0%
Strait of Georgia sport fishery									
1974	32	96	112	188	332	116	4	-	-
	3.6%	10.9%	12.7%	21.4%	37.7%	13.2%	0.5%	0.0%	0.0%
1975	60	108	144	192	332	260	140	104	44
	4.3%	7.8%	10.4%	13.9%	24.0%	18.8%	10.1%	7.5%	3.2%
1976	24	136	196	568	516	504	268	148	120
	1.0%	5.5%	7.9%	22.9%	20.8%	20.3%	10.8%	6.0%	4.8%
Mean:	3.0%	8.1%	10.3%	19.4%	27.5%	17.4%	7.1%	4.5%	2.7%

[a] Age 3_2 recoveries only.

ocean year, while the latter reflect either delays in the return of heads, smolts which reverted to parr after CWT application or adults which remained at sea an extra year.

Harvest Distribution

Geographic: Vedder-Chilliwack coho were harvested over a broad geographic range; however, over two-thirds of the annual harvest occurred in southern British Columbia waters, i.e. Georgia, Johnstone and Juan de Fuca straits and the west coast of Vancouver Island. Less than 7% of the harvest occurred north of Vancouver Island and south of Juan de Fuca Strait (Table 2). On average, the Strait of Georgia sport (36%) and troll (27%) fisheries harvested the largest proportion of the annual total, followed by the west coast of Vancouver Island troll fishery (15%) (Table 2; Fig. 3). Considerable variability was noted in the harvest distributions of 1974 brood and 1975-

Table 5. Estimated survival, harvest and exploitation rate of 1974-76 brood Vedder-Chilliwack River coho salmon.

	Dominant brood year		
	1974	1975	1976
Number released with CWTs [a]	17,515	20,679	31,567
Fishery Harvest [b]			
Age 2	0	34	80
Age 3	3,676	3,541	5,760
Age 4	4	13	14
Total	3,680	3,588	5,854
Percent of release	21.0%	17.4%	18.5%
Adult Escapement [c]			
Total	982	1,093	1,456
Survival to Harvest and Escapement			
Total	4,662	4,681	7,310
Percent of release	26.6%	22.6%	23.2%
Exploitation Rate	78.9%	76.7%	80.1%

[a] Adjusted for long term CWT loss (Schubert and Fleming 1989).
[b] From Appendix 1.
[c] From Schubert and Fleming (1989).

76 brood Vedder-Chilliwack coho. The proportion harvested in the west coast of Vancouver Island troll fishery declined from 23% of the 1974 brood to an average 11% of the 1975-76 broods, with similar trends in the B.C. net and U.S. fisheries. Harvest in the Strait of Georgia fisheries increased from 41% of the 1974 brood to an average 73% of the 1975-76 broods. The proportion of the hook and line fishery harvest occurring inside the Strait of Georgia showed a similar increase from 57% for the 1974 brood to an average 81% for the 1975-76 broods (Table 3), indicating an inside distribution for this stock but a shift in the degree of that distribution in 1978-79 harvest years.

Seasonal: Vedder-Chilliwack coho were harvested from January to December by the sport (38%), troll (48%) and net (14%) fisheries. The sport fishery harvest occurred throughout that period, with the majority harvested in June, July and August (Table 4). Troll fishery harvest occurred from June to October, with the peak in July (Table 4). Net fishery harvest occurred from June to November, with annual variability dependant upon target species strength (Appendix 1).

Survival and Exploitation Rate

The survival of Vedder-Chilliwack coho from age 1+ smolts averaged 19.0%

Table 6. Estimated harvest of coded wire tagged upper Chilliwack River system coho salmon in the major coastal fisheries. [a]

	Dominant brood year				
	1975	1976	1977	1978	Average
North and central coast troll	16 1.7%	6 2.3%	0 0.0%	25 5.6%	- 2.4%
West coast of Vancouver Island troll	156 16.9%	55 21.3%	133 27.0%	123 27.3%	- 23.2%
Strait of Georgia troll	254 27.5%	49 19.0%	51 10.4%	22 4.9%	- 15.4%
Strait of Georgia sport	260 28.2%	84 32.6%	129 26.2%	81 18.0%	- 26.2%
British Columbia net	90 9.8%	12 4.7%	59 12.0%	72 16.0%	- 10.6%
Puget Sound sport and net	93 10.1	19 7.4%	96 19.5%	94 20.9%	- 14.5%
Washington and Oregon sport and troll	53 5.7%	29 11.2%	24 4.9%	31 6.9%	- 7.2%
Miscellaneous sport and troll	0 0.0%	4 1.6%	0 0.0%	2 0.4%	- 0.5%
Total	922	258	492	450	-

[a] Includes all reported recoveries

(range 17.4% to 21.0%) to adult harvest and 24.1% (range 22.6% to 26.6%) in total (adult harvest plus escapement) (Table 5). Exploitation rates averaged 78.6% (range 76.7% to 80.1%).

UPPER CHILLIWACK RIVER

Harvest

The estimated annual harvest of coded wire tagged 1975-78 brood upper Chilliwack coho ranged from 258 to 922 (Table 6; Appendix 2). Harvest occurred predominantly at age 3_2, although up to 2% of the harvest of each brood year occurred at age 2_2 or 4_3 (Appendix 2). The former had recruited to the fisheries in October of their first ocean year, while the latter had probably remained in fresh water for a second winter.

Harvest Distribution

Geographic: Upper Chilliwack

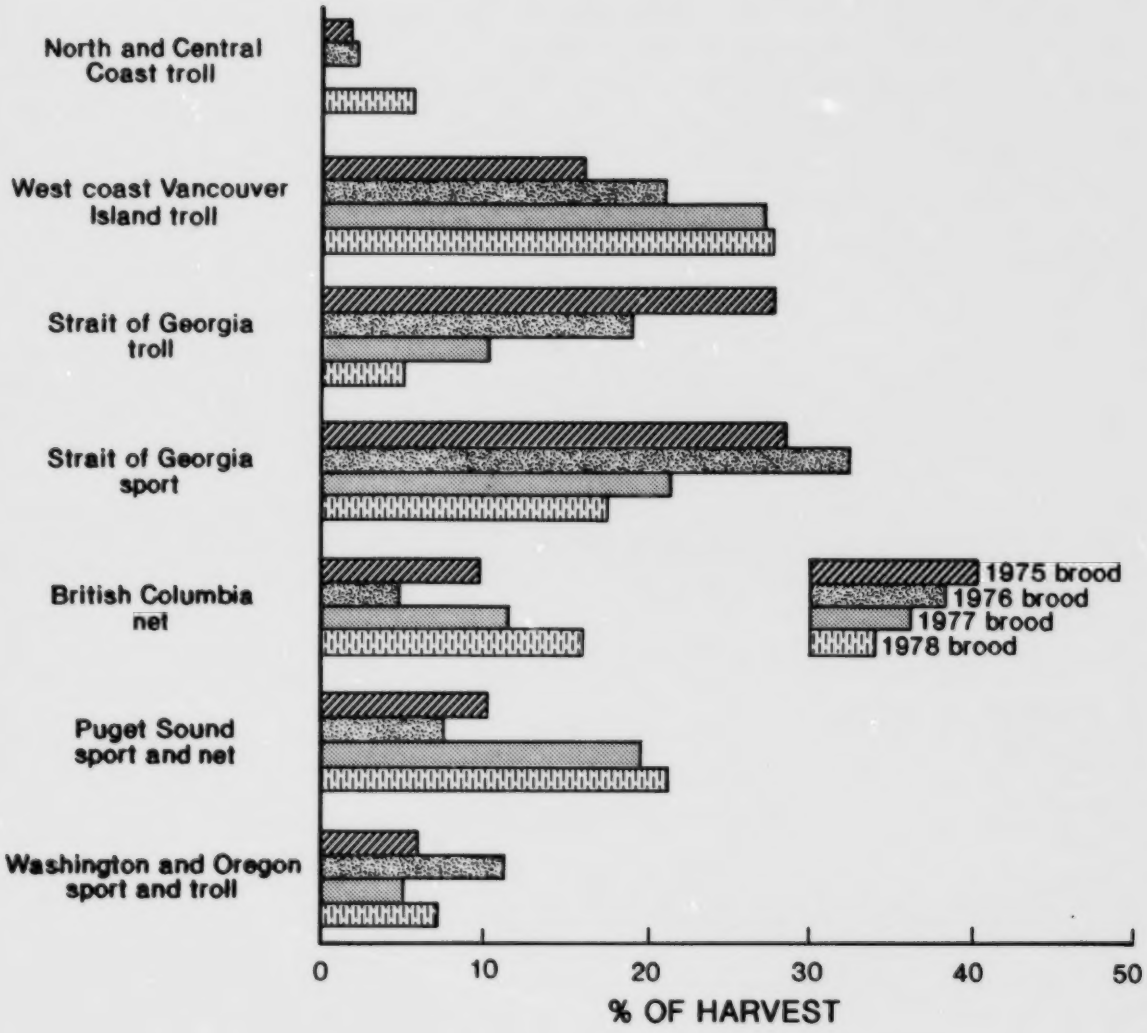

Figure 4 Distribution of the harvest of upper Chilliwack River coho salmon among the major fisheries. Percentages are based on the estimated number of CWTs taken in each fishery in the dominant harvest year.

Table 7. Distribution of the estimated harvest of coded wire tagged upper Chilliwack River coho salmon in the hook and line fisheries. [a]

	Dominant brood year			
	1975	1976	1977	1978
Outside fisheries				
North and central coast troll	16	6	0	25
	2.2%	2.7%	0.0%	9.0%
West coast of Vancouver Island troll	146	55	133	123
	19.9%	24.7%	40.4%	44.2%
Washington/Oregon sport and troll	53	29	24	31
	7.2%	13.0%	7.3%	11.2%
Inside fisheries				
Georgia Strait sport and troll	514	133	172	99
	70.1%	59.6%	52.3%	35.6%
Puget Sound sport	4	0	0	0
	0.5%	0.0%	0.0%	0.0%
Outside fisheries	29.3%	40.4%	47.7%	64.4%
Inside fisheries	70.7%	59.6%	52.3%	35.6%
Total hook and line harvest	733	223	329	278

[a] Age 3_2 recoveries only.

coho were harvested predominantly in southern British Columbia waters (Table 6; Appendix 2). On average, the Strait of Georgia sport fishery harvested the largest proportion of the annual total (26%), followed by the west coast of Vancouver Island troll (23%), Strait of Georgia troll (15%) and the Puget Sound fisheries (15%). Considerable interannual variability was noted, with the proportion of the annual harvest taken in the west coast of Vancouver Island (range 17% to 27%) and Puget Sound (range 7% to 21%) fisheries increasing and the proportion taken in the Strait of Georgia fisheries (range 23% to 56%) decreasing over the 1978-81 harvest period (Fig. 4). Different trends were noted in the two major fisheries within the Strait of Georgia, with progressive declines only in the troll fishery. The proportion of the hook and line fishery harvest occurring outside the Strait of Georgia progressively increased from 29% in 1978 to 64% in 1981 (Table 7). This suggests an increase in the

Table 8. Seasonal distribution of estimated coded wire tag recoveries of upper Chilliwack River coho salmon. [a]

Dominant brood year	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov-Dec
Commercial troll fisheries									
1975	-	-	-	155	205	72	34	-	-
	0.0%	0.0%	0.0%	33.3%	44.0%	15.5%	7.3%	0.0%	0.0%
1976	-	-	-	4	84	46	7	2	-
	0.0%	0.0%	0.0%	2.8%	58.7%	32.2%	4.9%	1.4%	0.0%
1977	-	-	-	23	127	43	10	3	-
	0.0%	0.0%	0.0%	11.2%	61.7%	20.9%	4.9%	1.5%	0.0%
1978	-	-	-	-	107	86	5	-	-
	0.0%	0.0%	0.0%	0.0%	54.0%	43.4%	2.5%	0.0%	0.0%
Mean:	0.0%	0.0%	0.0%	11.8%	54.6%	28.0%	4.9%	0.7%	0.0%
Strait of Georgia sport fishery									
1975	20	32	36	44	48	48	24	4	4
	7.7%	12.3%	13.8%	16.9%	18.5%	18.5%	9.2%	1.5%	1.5%
1976	-	4	8	36	16	12	8	-	-
	0.0%	4.8%	9.5%	42.9%	19.0%	14.3%	9.5%	0.0%	0.0%
1977	-	12	32	7	37	19	14	-	-
	0.0%	9.9%	26.4%	5.8%	30.6%	15.7%	11.6%	0.0%	0.0%
1978	-	-	8	22	26	9	8	4	-
	0.0%	0.0%	10.4%	28.6%	33.8%	11.7%	10.4%	5.2%	0.0%
Mean:	1.9%	6.7%	15.1%	23.5%	25.5%	15.0%	10.2%	1.7%	0.4%

[a] Age 3_2 recoveries only.

Table 9. Estimated survival, harvest and exploitation rate of 1975-78 brood upper Chilliwack River coho salmon.

	Dominant brood year			
	1975	1976	1977	1978
Number released with CWTs [a]	20,630	4,934	13,676	23,583
Fishery Harvest [b]				
Age 2	0	0	8	0
Age 3	912	258	484	446
Age 4	10	0	0	4
Total	922	258	492	450
Percent of release	4.5%	5.2%	3.6%	1.9%
Adult Escapement [c]				
Total	143	87	65	99
Survival to Harvest and Escapement				
Total	1,065	345	557	549
Percent of release	5.2%	7.0%	4.1%	2.3%
Exploitation Rate	86.6%	74.8%	88.3%	82.0%

[a] Adjusted for long term CWT loss (Schubert and Fleming 1989).
[b] From Appendix 2.
[c] From Schubert and Fleming (1989).

proportion of the stock migrating out of the Strait of Georgia, although a reduction in 1981 fishing effort in the Strait of Georgia troll fishery resulting from two area licensing may obscure the distribution in that year.

Seasonal: Upper Chilliwack coho were harvested from March to November by the sport (27%), troll (48%) and net (25%) fisheries (Appendix 2). Sport fishery harvest occurred through out the above period, with the peak harvest in June and July (Table 8). Troll fishery harvest occurred from June to October, with the peak in July (Table 8). A lack of harvest of the 1978 brood in June of 1981 reflected a delay in the west coast of Vancouver Island troll fishery opening until July 1, coincident with the Strait of Georgia.

Survival and Exploitation Rate

The survival of upper Chilliwack coho from age 0+ fry averaged 3.8% (range 1.9% to 5.2%) to adult harvest and 4.7% (range 2.3% to 7.0%) in total (Table 9). Exploitation rates averaged 82.9% (range 74.8% to 88.3%).

SALMON RIVER

Harvest

The estimated annual harvest of coded wire tagged 1976-78 brood Salmon

Table 10. Estimated harvest of coded wire tagged Salmon River system coho salmon in the major coastal fisheries. [a]

	Dominant brood year			
	1976	1977	1978	Average
North and central coast troll	5 0.5%	4 0.1%	116 4.3%	- 1.6%
West coast of Vancouver Island troll	117 11.6%	548 17.0%	686 25.5%	- 18.0%
Strait of Georgia troll	284 28.1%	573 17.8%	268 10.0%	- 18.6%
Strait of Georgia sport	460 45.5%	1,186 36.8%	924 34.3%	- 38.9%
British Columbia net	47 4.6%	297 9.2%	357 13.3%	- 9.0%
Puget Sound sport and net	71 7.0%	481 14.9%	215 8.0%	- 10.0%
Washington and Oregon sport and troll	18 1.8%	125 3.9%	119 4.4%	- 3.4%
Miscellaneous sport and troll	10 1.0%	9 0.3%	6 0.2%	- 0.5%
Total	1,012	3,223	2,691	-

[a] Includes all reported recoveries.

coho ranged from 1,012 to 3,223 (Table 10; Appendix 3). Less than 1% of the harvest occurred in the year preceding or following the dominant year of harvest (Appendix 3).

Harvest Distribution

Geographic: Salmon coho were harvested predominantly in southern British Columbia waters (Table 10; Appendix 3). On average, the Strait of Georgia sport (39%) and troll (19%) fisheries harvested the largest proportion of the annual total, followed by the west coast of Vancouver Island troll fishery (18%). Considerable variability was noted over the study period (Fig. 5). The proportion harvested in the west coast of Vancouver Island troll fishery increased from 12% of the 1976 brood to 26% of the 1978 brood, with a similar trend in the B.C. net fisheries. Harvest in the Strait of Georgia fisheries decreased from 74% of the 1976 brood

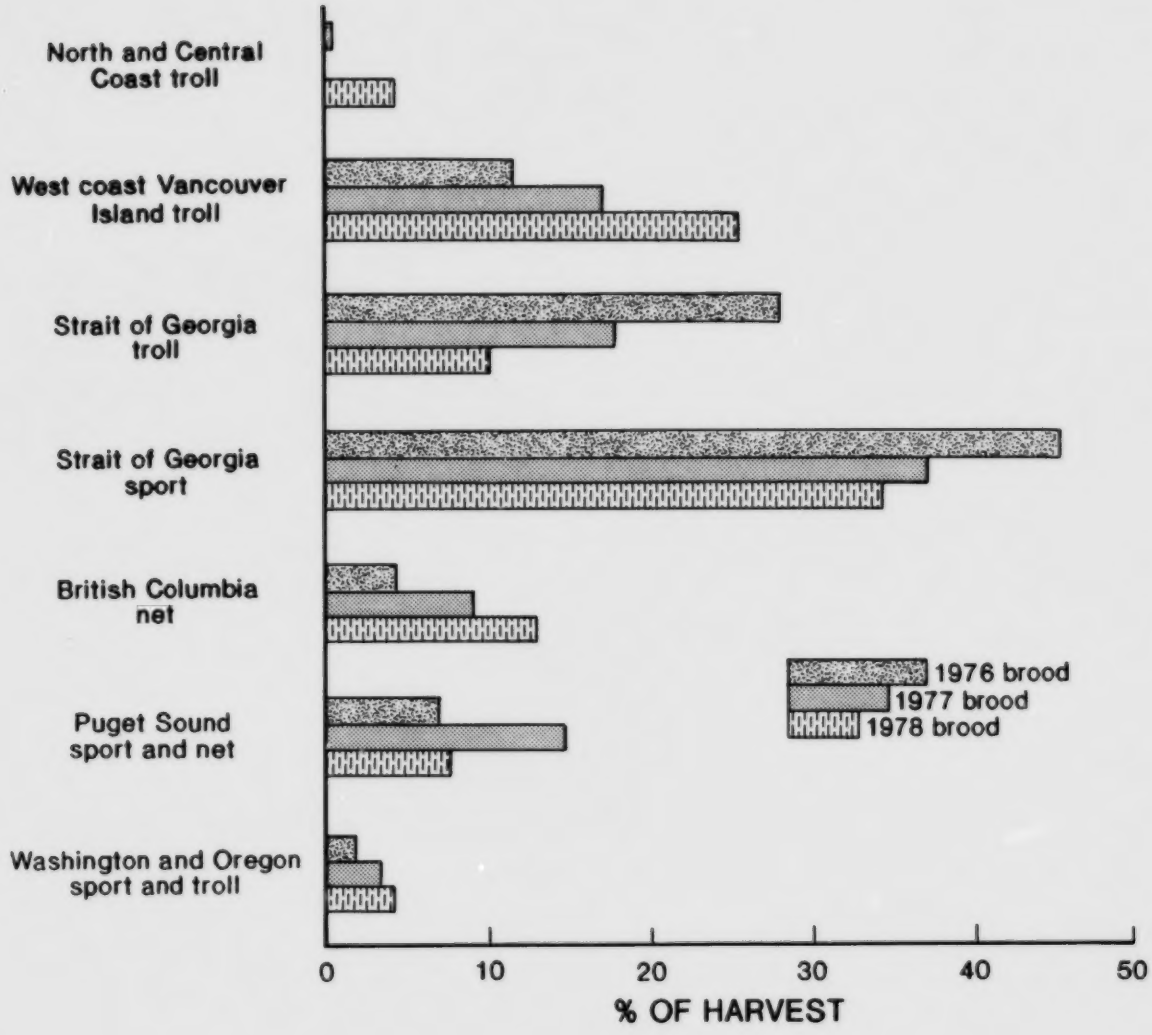

Figure 5 Distribution of the harvest of Salmon River coho salmon among the major fisheries. Percentages are based on the estimated number of CWTs taken in each fishery in the dominant harvest year.

Table 11. Distribution of the estimated harvest of coded wire tagged Salmon River coho salmon in the hook and line fisheries. [a]

	Dominant brood year		
	1976	1977	1978
Outside fisheries			
North and central coast troll	5	4	116
	0.5%	0.2%	5.4%
West coast of Vancouver Island troll	117	548	686
	12.9%	22.3%	32.2%
Washington/Oregon sport and troll	18	125	119
	2.0%	5.1%	5.6%
Inside fisheries			
Strait of Georgia sport and troll	740	1,743	1,192
	81.3%	70.8%	55.9%
Puget Sound sport	30	41	18
	3.3%	1.7%	0.8%
Outside fisheries	15.4%	27.5%	43.2%
Inside fisheries	84.6%	72.5%	56.8%
Total hook and line harvest	910	2,461	2,131

[a] Age 3_2 recoveries only.

to 44% of the 1978 brood. The proportion of the hook and line fishery harvest occurring inside the Strait of Georgia decreased from 85% of the 1976 brood to 57% of the 1978 brood (Table 11), indicating a generally inside distribution for this stock but with a progressive decline in the degree of that distribution over the study period.

Seasonal: Salmon coho were harvested from March to December by the sport (41%), troll (41%) and net (17%) fisheries. The sport fishery harvest occurred throughout that period, with the majority harvested in June, July and August (Table 12). Troll fishery harvest occurred from June to October, with the peak in July (Table 12). Net fishery harvest occurred from June to October, varying depending upon target species strength (Appendix 3).

Table 12. Seasonal distribution of the estimated harvest of coded wire tagged Salmon River coho salmon in the hook and line fisheries. [a]

Dominant brood year	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov-Dec
Commercial troll fisheries									
1976	-	-	-	12	283	76	59	-	-
	0.0%	0.0%	0.0%	2.8%	65.8%	17.7%	13.7%	0.0%	0.0%
1977	-	-	-	65	774	255	128	6	-
	0.0%	0.0%	0.0%	5.3%	63.0%	20.8%	10.4%	0.5%	0.0%
1978	-	-	-	-	707	298	170	1	-
	0.0%	0.0%	0.0%	0.0%	60.1%	25.3%	14.5%	0.1%	0.0%
Mean:	0.0%	0.0%	0.0%	2.7%	63.0%	21.3%	12.9%	0.2%	0.0%
Strait of Georgia sport fishery									
1976	-	16	68	84	80	132	60	12	4
	0.0%	3.5%	14.9%	18.4%	17.5%	28.9%	13.2%	2.6%	0.9%
1977	4	52	144	145	412	275	97	36	5
	0.3%	4.4%	12.3%	12.4%	35.2%	23.5%	8.3%	3.1%	0.4%
1978	-	37	86	240	319	170	68	4	-
	0.0%	4.0%	9.3%	26.0%	34.5%	18.4%	7.4%	0.4%	0.0%
Mean:	0.1%	4.0%	12.2%	18.9%	29.1%	23.6%	9.6%	2.0%	0.4%

[a] Age 3_2 recoveries only.

Table 13. Estimated survival, harvest and exploitation rate of 1976-78 brood Salmon River coho salmon.

	Dominant brood year		
	1976	1977	1978
Number released with CWTs [a]	12,103	29,082	28,423
Fishery Harvest [b]			
Age 2	4	12	8
Age 3	1,008	3,207	2,677
Age 4	0	4	6
Total	1,012	3,223	2,691
Percent of release	8.4%	11.1%	9.5%
Adult Escapement [c]			
Total	879	1,918	794
Survival to Harvest and Escapement			
Total	1,891	5,141	3,485
Percent of release	15.6%	17.7%	12.3%
Exploitation Rate	53.5%	62.7%	77.2%

[a] Adjusted for long term CWT loss (Schubert and Fleming 1989).
[b] From Appendix 3.
[c] From Schubert and Fleming (1989).

Survival and Exploitation Rate

The survival of Salmon coho from age 1+ smolts averaged 9.7% (range 8.4% to 11.1%) to adult harvest and 15.2% (range 12.3% to 17.7%) in total (Table 13). Exploitation rates averaged 64.5% (range 53.5% to 77.2%).

UPPER PITT RIVER

A relatively large part of each Upper Pitt coho brood remained in fresh water a second year and matured at age 4_3. Because CWTs were applied to rearing fry, it was possible to statistically compare the within year harvest of two successive brood years and of components of a single brood tagged at age 0+ and 1+. These results are reported below.

Harvest

The estimated annual harvest of coded wire tagged 1977-79 brood upper Pitt coho ranged from 699 to 1,931 (Table 14; Appendix 4). Harvest occurred predominantly at age 3_2; however, an average 19% of the total adult harvest of a complete brood year occurred at age 4_3. Virtually no harvest occurred at age 2_2 (Appendix 4).

Harvest Distribution

Geographic: Upper Pitt coho were

Table 14. Estimated harvest at age of coded wire tagged upper Pitt River system coho salmon in the major coastal fisheries.

Dominant brood year:	1977 brood	1978 brood				1979 brood			Aver-
Age at harvest:	Age 4[a]	Age 3	Age 4[b]	Age 4[a]	Total[c]	Age 3	Age 4[b]	Total[c]	age
North and central coast troll	60 8.6%	70 6.0%	7 2.9%	25 4.8%	102 5.3%	50 4.4%	39 12.8%	89 6.2%	- 6.7%
West coast of Vancouver Island Troll	263 37.6%	524 45.1%	110 45.5%	210 40.0%	844 43.7%	520 45.6%	150 49.2%	670 46.3%	- 42.5%
Strait of Georgia troll	67 9.6%	34 2.9%	24 9.9%	54 10.3%	112 5.8%	60 5.3%	10 3.3%	70 4.8%	- 6.7%
Strait of Georgia sport	111 15.9%	140 12.0%	31 12.8%	78 14.9%	249 12.9%	128 11.2%	48 15.7%	176 12.2%	- 13.6%
British Columbia net	84 12.0%	192 16.5%	39 16.1%	69 13.1%	302 15.6%	130 11.4%	26 8.5%	158 10.9%	- 12.9%
Puget Sound sport and net	86 12.3%	110 9.5%	26 10.7%	54 10.3%	190 9.8%	148 13.0%	28 9.2%	176 12.2%	- 11.4%
Washington and Oregon sport and troll	28 4.0%	87 7.5%	5 2.1%	34 6.5%	126 6.5%	98 8.6%	4 1.3%	102 7.0%	- 5.9%
Miscellaneous sport and troll	0 0.0%	5 0.4%	0 0.0%	1 0.2%	6 0.3%	6 0.5%	0 0.0%	6 0.4%	- 0.2%
Total	699	1,162	242	525	1,931	1,140	305	1,447	-

[a] CWT's applied at age 1+.
[b] CWT's applied at age 0+.
[c] Includes age 2_2 harvest.

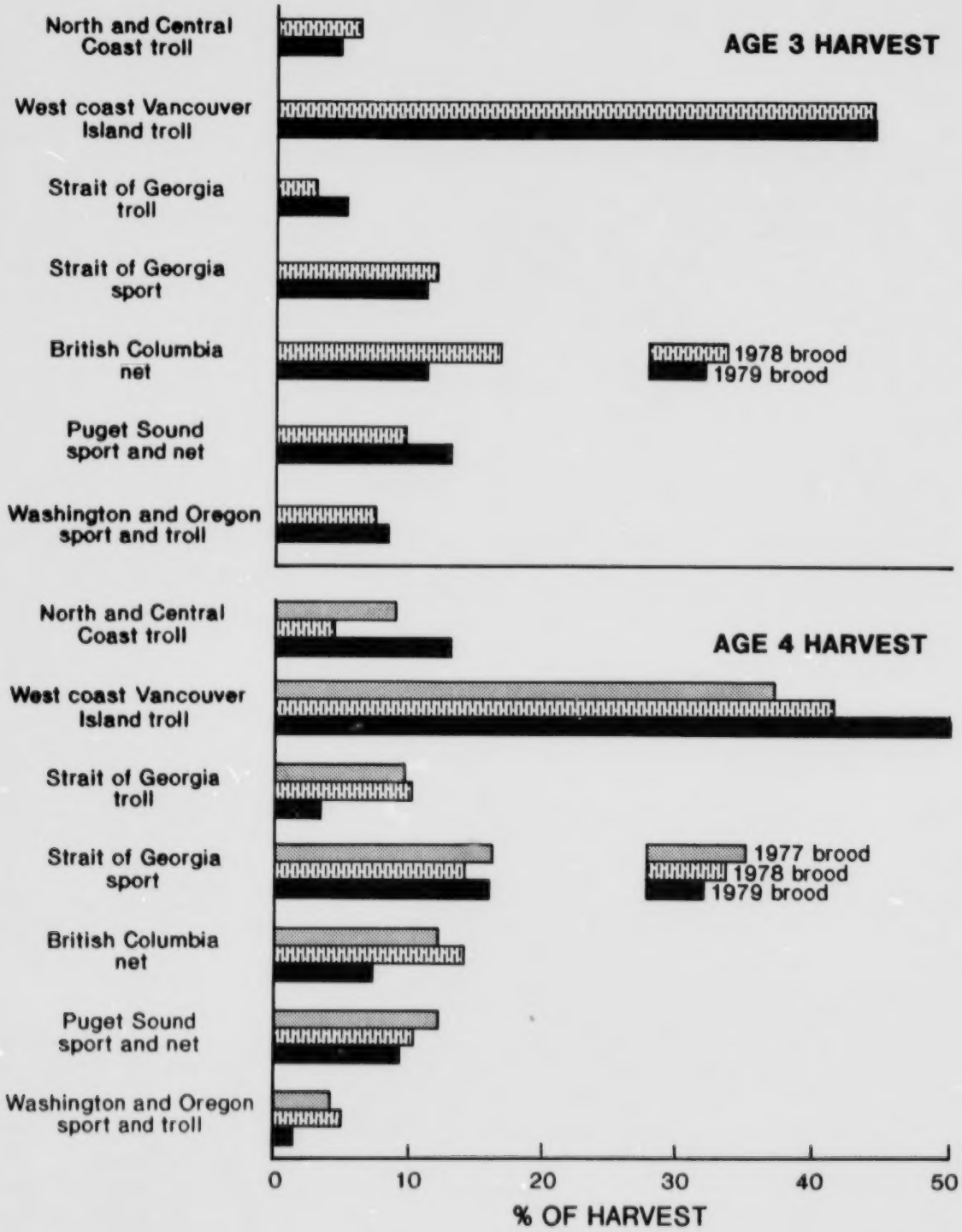

Figure 6 Distribution of the harvest, at ages 3 and 4 of upper Pitt River coho salmon among the major fisheries. Percentages are based on the estimated number of CWTs taken in each fishery.

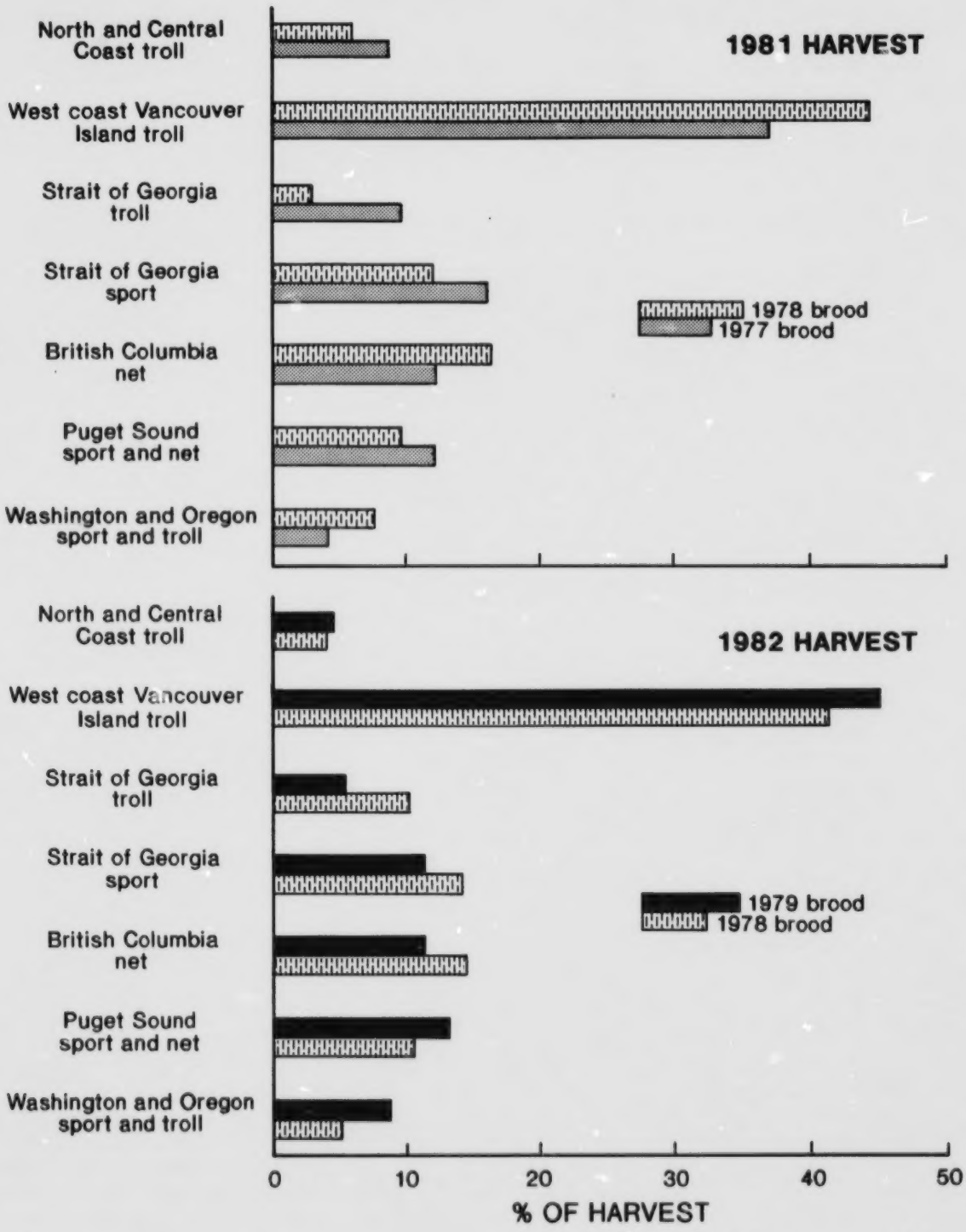

Figure 7 Distribution of the harvest, by brood year, of upper Pitt River coho salmon among the major fisheries in 1981 and 1982. Percentages are based on the estimated number of CWTs taken in each fishery.

Table 15. Distribution of the estimated harvest of coded wire tagged upper Pitt River coho salmon in the hook and line fisheries. [a]

Dominant brood year:	1977	1978		1979	
Age at harvest:	Age 4	Age 3	Age 4 [b]	Age 3	Age 4
Outside fisheries					
North and central coast troll	60	70	32	50	39
	11.2%	8.2%	5.3%	5.8%	15.5%
West coast of Vancouver Island troll	257	524	320	520	150
	48.1%	61.1%	52.6%	60.0%	59.8%
Washington/Oregon sport and troll	28	87	39	98	4
	5.2%	10.2%	6.4%	11.3%	1.6%
Inside fisheries					
Strait of Georgia sport and troll	178	174	187	188	58
	33.3%	20.3%	30.8%	21.7%	23.1%
Puget Sound sport	11	2	30	11	0
	2.1%	0.2%	4.9%	1.3%	0.0%
Outside fisheries	64.6%	79.5%	64.3%	77.0%	76.9%
Inside fisheries	35.4%	20.5%	35.7%	23.0%	23.1%
Total hook and line harvest	534	857	608	867	251

[a] Age 3_2 and 4_3 recoveries only.
[b] Sum of 1982 recoveries of 1979 age 0+ and 1980 age 1+ releases.

harvested predominantly in southern British Columbia waters (Table 14; Appendix 4). On average, the west coast of Vancouver Island troll fishery (43%) harvested the largest proportion of the annual total, followed by the Strait of Georgia sport (14%) and British Columbia net (13%) fisheries (Table 14; Figs. 6 and 7). The distribution of harvest was similar between brood and harvest years. The proportion of the annual hook and line fishery harvest occurring inside the Strait of Georgia averaged 26%, indicating an outside distribution for this stock (Table 15).

Statistical comparisons of within year harvest distributions were made between the observed harvest of 1977 and 1978 brood coho in 1981, 1978 and 1979 brood coho in 1982, and two groups of 1978 brood coho tagged at age 0+ and age 1+ and harvested in 1983. No significant difference was noted in the within year distributions

Table 16. Seasonal distribution of the estimated harvest of coded wire tagged upper Pitt River coho salmon in the hook and line fisheries. [a]

Harvest year	Dominant brood year	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov-Dec
Commercial troll fisheries										
1981	1977	-	-	-	-	241	165	3	-	-
		0.0%	0.0%	0.0%	0.0%	58.9%	40.3%	0.7%	0.0%	0.0%
	1978	-	-	-	1	376	199	137	-	-
		0.0%	0.0%	0.0%	0.1%	52.7%	27.9%	19.2%	0.0%	0.0%
1982	1978 [b]	-	-	-	5	308	91	61	-	-
		0.0%	0.0%	0.0%	1.1%	66.2%	19.6%	13.1%	0.0%	0.0%
	1979	-	-	-	11	469	136	-	-	-
		0.0%	0.0%	0.0%	1.5%	65.5%	19.0%	14.0%	0.0%	0.0%
1983	1979	-	-	-	-	141	30	10	18	-
		0.0%	0.0%	0.0%	0.0%	70.9%	15.1%	5.0%	9.0%	0.0%
Mean		0.0%	0.0%	0.0%	0.6%	62.9%	24.4%	10.4%	1.8%	0.0%
Strait of Georgia sport fishery										
1981	1977	4	19	15	18	17	26	12	-	-
		3.6%	17.1%	13.5%	16.2%	15.3%	23.4%	10.8%	0.0%	0.0%
	1978	4	9	18	41	43	17	8	-	-
		2.9%	6.4%	12.9%	29.3%	30.7%	12.1%	5.7%	0.0%	0.0%
1982	1978 [b]	4	-	18	16	29	33	9	-	-
		3.7%	0.0%	16.5%	14.7%	26.6%	30.3%	8.3%	0.0%	0.0%
	1979	4	8	21	11	37	40	4	2	-
		3.1%	6.3%	16.5%	8.7%	29.1%	31.5%	3.1%	1.6%	0.0%
1983	1979	-	4	6	16	8	6	3	4	-
		0.0%	8.5%	12.8%	34.0%	17.0%	12.8%	6.4%	8.5%	0.0%
Mean		2.7%	7.7%	14.4%	20.6%	23.8%	22.0%	6.9%	2.0%	0.0%

[a] Age 3_2 and 4_3 recoveries only.
[b] Sum of 1982 recoveries of 1979 age 0+ and 1980 age 1+ releases.

Table 17. Estimated survival, harvest and exploitation rate of 1977-79 brood upper Pitt River coho salmon.

Dominant brood year: Age at release:	1977 Age 1+	1978 Age 0+	1978 Age 1+	1979 Age 0+
Number released with CWTs [a]	15,938	51,841	13,428	60,592
Fishery Harvest [b]				
Age 2	0	2	0	2
Age 3	0	1,162	0	1,140
Age 4	699 [d]	242	525	305 [e]
Total	699	1,406	525	1,447
Percent of release:	4.4%	2.7%	3.9%	2.4%
Adult Escapement [c]				
Age 3	0	270	0	339
Age 4	240	36	267	66
Total	240	306	267	405
Survival to Harvest and Escapement				
Total	939	1,712	792	1,852
Percent of release	5.9%	3.3%	5.9%	3.1%
Exploitation Rate				
Age 3	n/a	81.2%	n/a	77.1%
Age 4	74.4%	87.1%	66.3%	82.2%
Total	74.4%	82.1%	66.3%	78.1%

[a] Adjusted for long term CWT loss (Schubert and Fleming 1989).
[b] From Appendix 4.
[c] From Schubert and Fleming (1989).
[d] Includes reported harvest of eight at age 5.
[e] Includes reported harvest of four at age 5.

of any group (G-test; $p > 0.05$), except marginal differences ($p<0.05$) were noted in 1981. This tends to indicate that marine distributions were not brood year specific. Similarly, no differences were noted in the distribution of hook and line recoveries or in the recoveries in north and south approach net fisheries.

Seasonal: Upper Pitt coho were harvested from February to October by the sport (16%), troll (61%) and net (23%) fisheries. The sport fishery harvest occurred through out that period, with the majority harvested in June, July and August (Table 16). Troll fishery harvest occurred from June to October, with the peak in July (Table 16). Net fishery harvest occurred from June to October, varying depending upon target species strength (Appendix 4). No significant difference was noted in the seasonal harvest pattern in any year ($p > 0.05$).

Table 18. Estimated harvest of coded wire tagged Birkenhead River system coho salmon in the major coastal fisheries. [a]

Dominant brood year:	1980	1981			
Age at harvest:	Age 4 [b]	Age 3	Age 4 [c]	Average	Combined
North and central coast troll	0 0.0%	16 1.5%	0 0.0%	- 0.5%	- 1.3%
West coast of Vancouver Island troll	73 75.3%	837 79.0%	40 52.6%	- 69.0%	- 77.1%
Strait of Georgia troll	0 0.0%	18 1.7%	0 0.0%	- 0.6%	- 1.5%
Strait of Georgia sport	13 13.4%	72 6.8%	7 9.2%	- 9.8%	- 7.5%
British Columbia net	2 2.1%	46 4.3%	6 7.9%	- 4.8%	- 4.4%
Puget Sound sport and net	9 9.3%	27 2.5%	16 21.1%	- 11.0%	- 4.2%
Washington and Oregon sport and net	0 0.0%	41 3.9%	7 9.2%	- 4.4%	- 3.9%
Miscellaneous sport and troll	0 0.0%	2 0.2%	0 0.0%	- 0.1%	- 0.2%
Total	97	1,059	76	-	-

[a] Includes all reported recoveries.
[b] CWT's applied at age 1+.
[c] CWT's applied at age 0+.

Survival and Exploitation Rate

The survival of Upper Pitt coho from age 0+ and age 1+ fry averaged 2.6% and 4.2%, respectively, to adult harvest and 3.2% and 5.9%, respectively, in total (Table 17). Exploitation rates averaged 80.1% for coho released with CWTs at age 0+ and harvested at ages 3_2 and 4_3. Exploitation rates averaged 70.4% for coho released at age 1+ harvested at age 4_3.

BIRKENHEAD RIVER

Harvest

The estimated annual harvest of coded wire tagged 1980-81 brood Birkenhead coho ranged from 97 to 1,135 (Table 18; Appendix 5). Harvest occurred predominantly at age 3_2, although up to 7% of the 1981 brood harvest occurred at age 4_3 (Appendix 5).

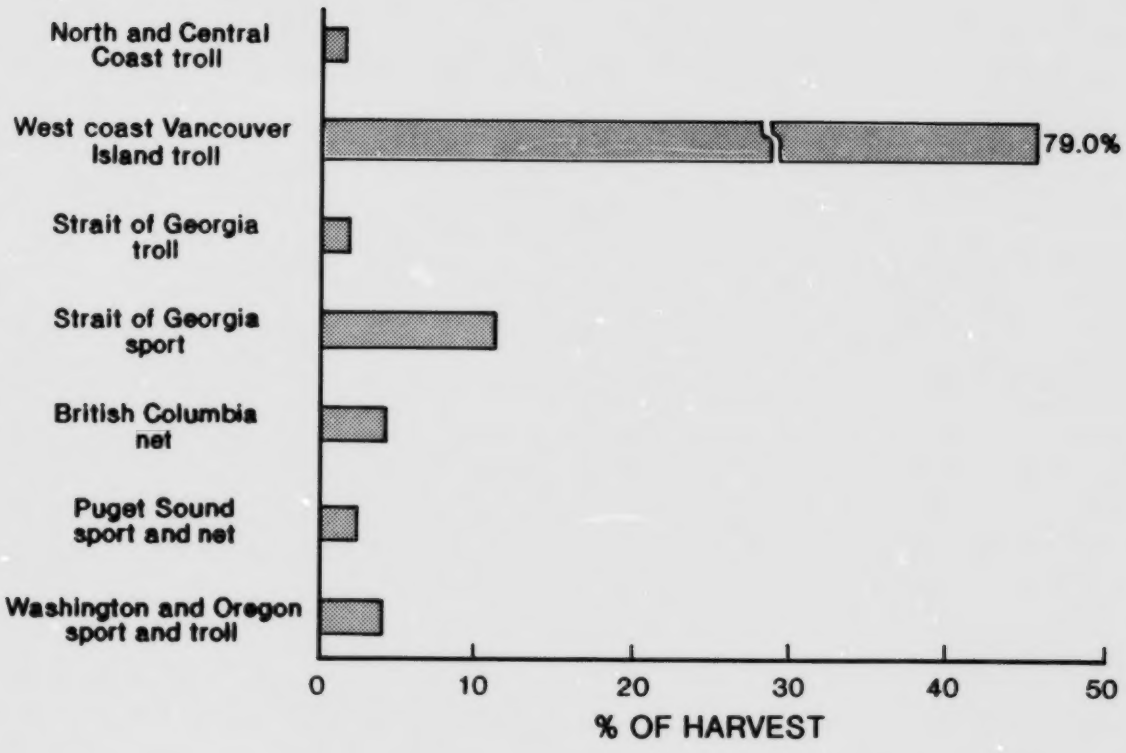

Figure 8 Distribution of the harvest of 1981 brood Birkenhead River coho salmon among the major fisheries. Percentages are based on the estimated number of CWTs taken in each fishery

Table 19. Distribution of the estimated harvest of coded wire tagged Birkenhead River coho salmon in the hook and line fisheries. [a]

Dominant brood year:	1980 [b]	1981 [c]		
Age at harvest:	Age 4	Age 3	Age 4	Combined
Outside fisheries				
North and central coast troll	0 0.0%	16 1.6%	0 0.0%	16 1.4%
West coast of Vancouver Island troll	73 81.1%	837 84.7%	40 61.5%	950 83.1%
Washington/Oregon sport and troll	0 0.0%	41 4.1%	7 10.8%	48 4.2%
Inside fisheries				
Strait of Georgia sport and troll	13 14.4%	90 9.1%	7 10.8%	110 9.6%
Puget Sound sport	4 4.4%	4 0.4%	11 16.9%	19 1.7%
Outside fisheries	81.1%	90.5%	72.3%	88.7%
Inside fisheries	18.9%	9.5%	27.7%	11.3%
Total hook and line harvest	90	988	65	1,143

[a] Age 3_2 and 4_3 recoveries only.
[b] CWT's applied at age 1+.
[c] CWT's applied at age 0+.

Harvest Distribution

Geographic: Birkenhead coho were harvested predominantly in southern British Columbia waters (Table 18; Appendix 5). On average, the west coast of Vancouver Island troll fishery harvested the largest proportion of the annual total (69%), followed by the Puget Sound fisheries (11%) and the Strait of Georgia sport fishery (10%) (Fig. 8). Variability in harvest distributions was noted between brood years; however, sample sizes did not permit comparisons. The distribution of harvest in the hook and line fisheries suggests a markedly outside distribution for this stock (Table 19).

Seasonal: Birkenhead coho were harvested from April to October by the sport (14%), troll (79%) and net (7%) fisheries (Appendix 5). Sport

Table 20. Seasonal distribution of the estimated harvest of coded wire tagged Birkenhead River coho salmon in the hook and line fisheries.[a]

Harvest year	Dominant brood year	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov-Dec
Commercial troll fisheries										
1984	1980	-	-	-	-	36	19	18	-	-
		0.0%	0.0%	0.0%	0.0%	49.3%	26.0%	24.7%	0.0%	0.0%
	1981	-	-	-	-	396	318	173	-	-
		0.0%	0.0%	0.0%	0.0%	44.6%	35.9%	19.5%	0.0%	0.0%
1985	1981	-	-	-	-	20	16	8	-	-
		0.0%	0.0%	0.0%	0.0%	45.5%	36.4%	18.2%	0.0%	0.0%
Mean:		0.0%	0.0%	0.0%	0.0%	46.5%	32.7%	20.8%	0.0%	0.0%
Strait of Georgia sport fishery										
1984	1980	-	3	-	10	-	-	-	-	-
		0.0%	23.1%	0.0%	76.9%	0.0%	0.0%	0.0%	0.0%	0.0%
	1981	-	5	3	33	25	5	-	-	-
		0.0%	7.0%	4.2%	46.5%	35.2%	7.0%	0.0%	0.0%	0.0%
1985	1981	-	4	-	3	-	-	-	-	-
		0.0%	57.1%	0.0%	42.9%	0.0%	0.0%	0.0%	0.0%	0.0%
Mean:		0.0%	29.1%	1.4%	55.4%	11.7%	2.3%	0.0%	0.0%	0.0%

[a] Age 3_2 and 4_3 recoveries only.

Table 21. Estimated survival, harvest and exploitation rate of 1980-81 brood Birkenhead River coho salmon.

Dominant brood year: Age at release:	1980 Age 1+	1981 Age 0+
Number released with CWTs [a]	3,125	39,754
Fishery Harvest [b]		
Age 2	0	0
Age 3	0	1,059
Age 4	97	76
Total	97	1,135
Percent of release	3.1%	2.9%
Adult Escapement [c]		
Age 3	0	327
Age 4	31	0 [d]
Total	31	327
Survival to Harvest and Escapement		
Total	128	1,462
Percent of release	4.1%	3.7%
Exploitation Rate	75.8%	77.6%

[a] Adjusted for long term CWT loss (Schubert and Fleming 1989).
[b] From Appendix 5.
[c] From Schubert et al. (1985).
[d] Not assessed.

fishery harvest occurred from April to August, with the majority harvested in June (Table 20). Troll fishery harvest occurred from July to September, with the peak in July (Table 20).

Survival and Exploitation Rate

The survival of Birkenhead coho from age 0+ and age 1+ fry was 2.9% and 3.1% to adult harvest, respectively, and 3.7% and 4.1% in total (Table 21). Exploitation rates were 77.6% for the age 0+ release and 75.8% for the age 1+ release.

CAMPBELL RIVER

Harvest

The estimated annual harvest of coded wire tagged 1980 brood Campbell coho was 1,600 (Table 22; Appendix 6). Less than 1% of the harvest occurred in the year preceding the dominant year of harvest (Appendix 6).

Harvest Distribution

Geographic: Campbell coho were harvested predominantly in southern British Columbia waters (Table 22;

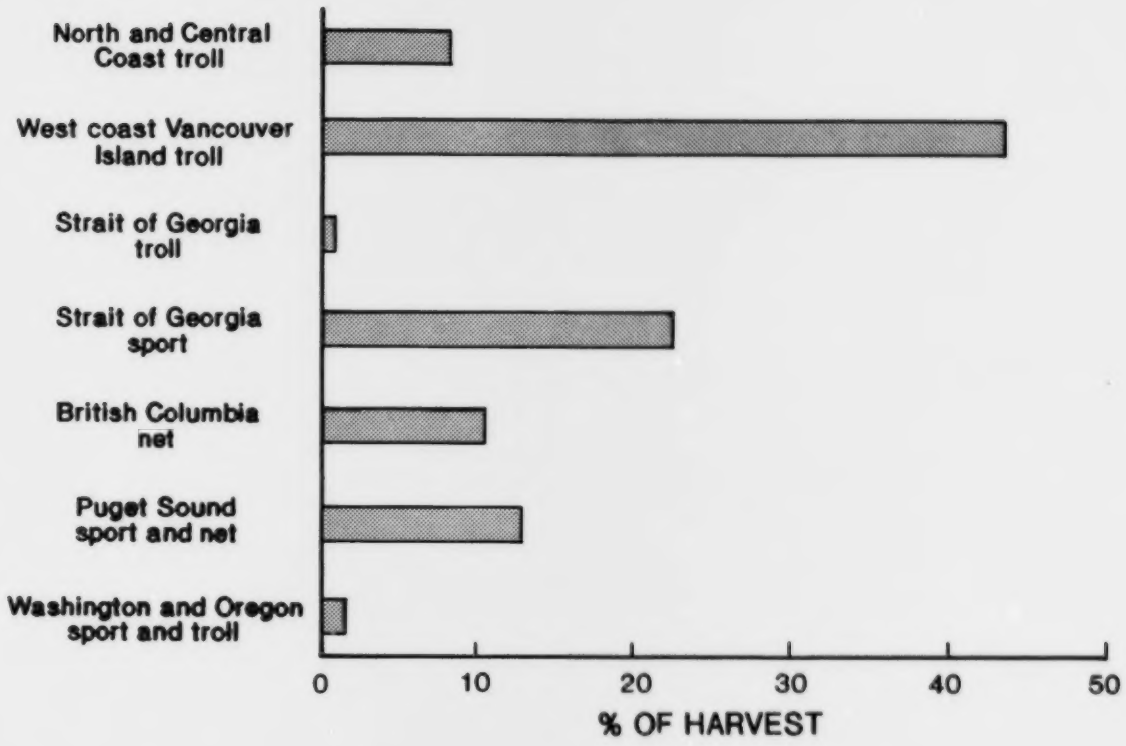

Figure 9 Distribution of the harvest of 1980 brood Campbell River coho salmon among the major fisheries. Percentages are based on the estimated number of CWTs taken in each fishery.

Table 22. Estimated harvest of coded wire tagged Campbell River system coho salmon in the major coastal fisheries. [a]

Dominant brood year:	1980
North and central coast troll [b]	128 8.0%
West coast of Vancouver Island troll	693 43.3%
Strait of Georgia troll	12 0.8%
Strait of Georgia sport	355 22.2%
British Columbia net	163 10.2%
Puget Sound sport and net	202 12.6%
Washington and Oregon sport and troll	26 1.6%
Miscellaneous sport and troll	21 1.3%
Total	1,600

[a] Includes all reported recoveries.
[b] Includes 3_2 recoveries in Alaska.

Appendix 6). The west coast of Vancouver Island troll fishery (43%) harvested the largest proportion of the annual total, followed by the Strait of Georgia sport (22%) and Puget Sound sport and net (13%) fisheries (Table 22; Fig. 9). The proportion of the hook and line fishery harvest occurring inside the Strait of Georgia was 33% (Table 23), indicating an outside distribution in 1983.

Seasonal: Campbell coho were harvested from January to October by the sport (26%), troll (54%) and net (20%) fisheries. The sport fishery harvest occurred through out that period, with the majority harvested in June, July and August (Table 24). Troll fishery harvest occurred from July to October, with the peak in July (Table 24). Net fishery harvest occurred from July to October, with most of the harvest occurring in Puget Sound and Johnstone Strait (Appendix 6).

Table 23. Distribution of the estimated harvest of coded wire tagged Campbell River coho salmon in the hook and line fisheries. [a]

Dominant brood year:	1980
Outside fisheries	
North and central coast troll	128 10.2%
West coast of Vancouver Island troll	693 55.1%
Washington/Oregon sport and troll	26 2.1%
Inside fisheries	
Strait of Georgia sport and troll	365 29.0%
Puget Sound sport	45 3.6%
Outside fisheries	67.4%
Inside fisheries	32.6%
Total hook and line harvest	1,257

[a] Age 3_2 recoveries only.

Table 24. Seasonal distribution of the estimated harvest of coded wire tagged Campbell River coho salmon in the hook and line fisheries. [a]

Dominant brood year	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov-Dec
Commercial troll fisheries									
1980	- 0.0%	- 0.0%	- 0.0%	- 0.0%	546 63.8%	189 22.1%	96 11.2%	25 2.9%	- 0.0%
Strait of Georgia sport fishery									
1980	5 1.4%	12 3.4%	37 10.5%	125 35.4%	64 18.1%	67 19.0%	30 8.5%	13 3.7%	- 0.0%

[a] Age 3_2 recoveries only.

Table 25. Estimated survival, harvest and exploitation rate of 1980 brood Campbell River coho salmon.

Dominant brood year:	1980
Number released with CWTs [a]	15,637
Fishery Harvest [b]	
Age 2	7
Age 3	1,590
Age 4	0
Total	1,597
Percent of release	10.2%
Adult Escapement [c]	
Total	953
Survival to Harvest and Escapement	
Total	2,550
Percent of release	16.3%
Exploitation Rate	62.6%

[a] Adjusted for long term CWT loss (Schubert and Fleming 1989).
[b] From Appendix 6.
[c] From Schubert and Fleming (1989).

Survival and Exploitation Rate

The survival of Campbell coho from age 1+ smolts was 10.2% to adult harvest and 16.3% in total (Table 25). The exploitation rate was 62.6%.

BETWEEN STOCK COMPARISONS

Harvest Distribution

Observed CWT recoveries during 1977-84 permitted 11 within year, between stock statistical comparisons of harvest distribution (Table 26). Test results, summarized in Table 27, addressed four questions. First, differences in harvest distribution were examined by comparing observed harvest grouped by fishery (Table 28). Second, differences in overall marine distribution were examined by comparing observed harvest in the inside and outside hook and line fisheries (Table 29). Initial tests showed no distributional differences within the three outside hook and line fisheries. Third, differences in the return route from outside waters were examined by comparing observed harvest in the net fisheries at the north and south approaches to the Strait of Georgia (Table 29). Fourth, differences in fishery recruitment timing were examined by comparing observed monthly harvest in the Strait of Georgia sport fishery. This fishery was selected for the protracted period of harvest and because harvest of most stocks was relatively large.

Table 26. Matrix of stocks by year for which observed CWT recoveries were sufficient to permit statistical comparison of harvest distributions. [a]

Harvest year	Stock	Stock: Vedder-Chilliwack River	Salmon River	Upper Pitt River	Campbell River	Salwein Creek
1978	Upper Chilliwack River	X	-	-	-	-
1979	Upper Chilliwack River	X	X	-	-	-
	Vedder-Chilliwack River	-	X	-	-	-
1980	Upper Chilliwack River	-	X	-	-	-
1981	Upper Chilliwack River	-	X	X	-	-
	Upper Pitt River	-	X	-	-	-
1983	Upper Pitt River	-	-	-	X	X
	Campbell River	-	-	-	-	X

[a] X denotes sufficent recoveries for statistical comparison.

Test results are summarized by harvest year below. Results were reported only when recoveries were sufficient to permit statistical comparisons.

1978: Observed harvest distributions were compared for Vedder-Chilliwack and upper Chilliwack coho. Significant differences were noted in the overall distribution and the distribution between inside and outside hook and line fisheries but not in the seasonal distribution in the Strait of Georgia sport fishery. Distribution differences were greatest in the Strait of Georgia fisheries, which harvested a smaller proportion of upper Chilliwack River coho; however, both stocks had an inside distribution and similar rank orders of harvest by fishery.

1979: Observed harvest distributions were compared for Vedder- Chilliwack, upper Chilliwack and Salmon coho. No significant difference was noted between Vedder-Chilliwack and Salmon coho in overall distribution, distribution between inside and outside hook and line fisheries or north and south approach net fisheries. Seasonal harvest differed in the Strait of Georgia sport fishery. Both stocks were significantly different from upper Chilliwack coho in all tests where sample size permitted comparison except in seasonal distribution. Distribution differences were greatest in the Strait of Georgia fisheries, which harvested a smaller proportion of upper Chilliwack River coho, and in the coastal hook and line fisheries in Washington and Oregon, which harvested a larger proportion of that stock; however, all three stocks had an inside distribution.

1980: Observed harvest distributions were compared for upper Chilliwack and Salmon coho. No significant

Table 27. Results of four G-test comparisons of within-year differences in observed CWT recoveries by stock pair. [a]

		Test of difference in harvest distribution [b]			
Year	Stock comparison	Overall	Inside/outside Hook and line fisheries	North and south approach net fisheries	Seasonal in Strait of Georgia sport fishery
1978	Vedder-Chilliwack River Upper Chilliwack River	0.005	0.005	n/r	NS
1979	Vedder-Chilliwack River Upper Chilliwack River	0.050	0.005	n/r	NS
	Vedder-Chilliwack River Salmon River	NS	NS	NS	0.050
	Upper Chilliwack River Salmon River	0.005	0.005	n/r	n/r
1980	Upper Chilliwack River Salmon River	NS	0.005	NS	n/r
1981	Upper Chilliwack River Salmon River	0.010	0.005	0.005	n/r
	Upper Chilliwack River Upper Pitt River	NS	NS	NS	n/r
	Salmon River Upper Pitt River	0.001	0.005	0.005	NS
1983	Upper Pitt River Campbell River	NS	NS	n/r	n/r
	Upper Pitt River Salwein Creek[c]	0.001	0.005	n/r	n/r
	Campbell River Salwein Creek[c]	0.001	0.005	n/r	NS

[a] NS denotes no significant difference ($p < 0.05$)
n/r denotes a sample size insufficient for statistical comparison.
[b] See Methods for description of fishery groups.
[c] Distribution data from Schubert and Lister (1986).

Table 28. Observed CWT recoveries of study coho stocks among the major fisheries.

Harvest year	System	North and central coast troll	West coast of Vancouver Island troll	Strait of Georgia troll	Strait of Georgia sport	British Columbia net	Puget Sound sport and net	Washington/ Oregon sport and troll
1978	Vedder-Chilliwack River	11 1.0%	61 5.3%	570 49.5%	346 30.0%	64 5.6%	66 5.7%	34 3.0%
	Upper Chilliwack River	6 2.1%	28 9.8%	110 38.3%	65 22.6%	32 11.1%	33 11.5%	13 4.5%
1979	Vedder-Chilliwack River	25 1.6%	112 7.0%	660 41.4%	620 38.8%	62 3.9%	66 4.1%	51 3.2%
	Upper Chilliwack River	2 2.9%	8 11.6%	22 31.9%	21 30.4%	4 5.8%	4 5.8%	8 11.6%
	Salmon River	1 0.3%	18 6.2	120 41.1%	114 39.0%	17 5.8%	17 5.8%	5 1.7%
1980	Upper Chilliwack River	0 0.0%	25 17.7%	22 15.6%	26 18.4%	22 15.6%	36 25.5%	10 7.1%
	Salmon River	1 0.1%	100 11.1%	213 23.7%	258 28.7%	118 13.1%	170 18.9%	38 4.2%
1981	Upper Chilliwack River	4 4.3%	15 16.0%	4 4.3%	20 21.3%	16 17.0%	24 25.5%	11 11.7%
	Salmon River	22 3.7%	7 13.3%	62 10.5%	238 40.5%	87 14.8%	61 10.4%	40 6.8%
	Upper Pitt River [a]	22 6.1%	90 25.1%	20 5.6%	66 18.4%	66 18.4%	56 15.6%	39 10.9%
1983	Upper Pitt River	6 10.2%	20 33.9%	1 1.7%	15 25.4%	6 10.2%	9 15.3%	2 3.4%
	Campbell River	21 6.0%	94 26.7%	3 0.9%	114 32.4%	37 10.5%	71 20.2%	12 3.4%
	Salwein Creek [b]	15 5.1%	38 12.8%	7 2.4%	197 66.6%	21 7.1%	14 4.7%	4 1.4%

[a] Sum of two CWT codes.
[b] From Schubert and Lister (1986).

Table 29. Observed CWT recoveries of study coho stocks among the hook and line and approach net fisheries.

Harvest year	System	Hook and line fisheries			Net fisheries		
		Inside	Outside	Total	North approach	South approach	Total
1978	Vedder-Chilliwack River	918	106	1,024	30	12	42
		89.6%	10.4%	-	71.4%	28.6%	-
	Upper Chilliwack River	176	47	223	2	10	12
		78.9%	21.1%	-	16.7%	83.3%	-
1979	Vedder-Chilliwack River	1,300	188	1,488	27	48	75
		87.4%	12.6%	-	36.0%	64.0%	-
	Upper Chilliwack River	43	18	61	3	1	4
		70.5%	29.5%	-	75.0%	25.0%	-
	Salmon River	238	24	262	10	10	20
		90.8%	9.2%	-	50.0%	50.0%	-
1980	Upper Chilliwack River	48	35	83	7	7	14
		57.8%	42.2%	-	50.0%	50.0%	-
	Salmon River	477	139	616	21	42	63
		77.4%	22.6%	-	33.3%	66.7%	-
1981	Upper Chilliwack River	24	30	54	5	15	20
		44.4%	55.6%	-	25.0%	75.0%	-
	Salmon River	304	140	444	59	34	93
		68.5%	31.5%	-	63.4%	36.6%	-
	Upper Pitt River [a]	90	151	241	22	51	73
		37.3%	62.7%	-	30.1%	69.9%	-
1983	Upper Pitt River	16	28	44	2	5	7
		36.4%	63.6%	-	28.6%	71.4%	-
	Campbell River	124	127	251	26	17	43
		49.4%	50.6%	-	60.5%	39.5%	-
	Salwein Creek [b]	207	57	264	15	4	19
		78.4%	21.6%	-	78.9%	21.1%	-

[a] Sum of two CWT codes.
[b] From Schubert and Lister (1986).

Table 30. Between-stock comparisons of survival to harvest and escapement.

	1976 brood		1978 brood		1980 brood	
	Vedder-Chilliwack River	Salmon River	Upper Chilliwack River	Upper Pitt River	Campbell River	Salwein Creek [a]
Release type	Smolt	Smolt	Age 0+	Age 0+	Smolt	Smolt
Number released with CWTs	31,567	12,103	23,583	51,841	15,637	11,776
Observed Fishery Harvest						
Age 2	20	1	0	1	6	8
Age 3	1617	295	96	217	356	330
Age 4	4	0	1	52	0	0
Total	1,641	296	97	270	362	338
Percent of release	5.2%	2.4%	0.4%	0.5%	2.3%	2.9%
Estimated Fishery Harvest						
Age 2	80	4	0	2	7	19
Age 3	5,760	1,008	446	1,162	1,590	1,344
Age 4	14	0	4	242	0	0
Total	5,854	1,012	450	1,406	1,597	1,363
Percent of release	18.5%	8.4%	1.9%	2.7%	10.2%	11.6%
Adult Escapement						
Total	-	-	-	-	953	507
Survival to Estimated Harvest and Escapement						
Total	-	-	-	-	2,550	1,870
Percent of release	-	-	-	-	16.3%	15.9%
Exploitation Rate	-	-	-	-	62.6%	72.9%

[a] From Schubert and Lister (1986).

difference was noted in the overall distribution where, with the exception of the Strait of Georgia troll fishery, between stock differences were less than 6%, or in the distribution between northern and southern approach net fisheries. Distribution differences between inside and outside hook and line fisheries were significant, and large differences were noted in the rank order of harvest by fishery. Sample size was insufficient to test for seasonal differences in the Strait of Georgia sport fishery.

1981: Observed harvest distributions were compared for upper Chilliwack, Salmon and upper Pitt coho. No significant difference was noted between upper Chilliwack and upper Pitt coho in overall distribution or

the distribution between inside and outside hook and line fisheries or north and south approach net fisheries. However, both stocks were significantly different from Salmon coho in all tests where sample size permitted comparison. Distribution differences were greatest in the Strait of Georgia sport fishery, which harvested a larger proportion of Salmon coho. Salmon coho had an inside distribution while upper Chilliwack and upper Pitt coho had outside distributions. As well, the harvest of Salmon coho was higher in the north approach net fishery.

1983: Observed harvest distributions were compared for upper Pitt, Campbell and Salwein coho. No significant difference was noted between upper Pitt and Campbell stocks in overall distribution, the distribution between inside and outside hook and line fisheries or in the seasonal harvest in the Strait of Georgia sport fishery. Both stocks were significantly different from Salwein coho in all tests where sample size permitted comparison, except no difference was noted in seasonal harvest in the Strait of Georgia sport fishery. Distribution differences were greatest in the Strait of Georgia sport and west coast of Vancouver Island troll fisheries, reflecting the pronounced inside harvest distribution of Salwein coho. As well, a higher proportion of Salwein coho were harvested in the north approach net fishery.

Survival to Harvest and Escapement

Within year, between stock comparisons of survival to harvest were restricted to CWT groups released at similar ages. This permitted three comparisons: 1976 brood Vedder-Chilliwack and Salmon coho, 1978 brood upper Chilliwack and upper Pitt coho, and 1980 brood Campbell and Salwein coho.

Survival differences of 1976 brood Vedder-Chilliwack (5.2%) and Salmon (2.4%) coho were highly significant ($p < 0.05$) (Table 30). Survival differences between 1978 brood upper Chilliwack (0.4%) and upper Pitt (0.5%) coho were significant at the 0.05 level, but not at the 0.025 level. Survival differences between 1980 brood Campbell (2.3%) and Salwein (2.9%) coho were small but highly significant ($p < 0.005$). As well, a difference was noted in both total survival and exploitation rate, with the exploitation rate of Salwein coho exceeding Campbell coho by 10.3 percentage points (Table 30).

SUMMARY AND DISCUSSION

VEDDER-CHILLIWACK RIVER

Vedder-Chilliwack coho had a high apparent residency in the Strait of Georgia. Strait of Georgia fisheries harvested 41% to 74% of the annual total (Table 31), while harvest by the inside hook and line fisheries ranged from 57% to 83% of the hook and line harvest (Table 32). Annual harvest by fishery was variable, with a progressive increase in the sport harvest, a static troll harvest and a progressive decrease in the net harvest. These trends may reflect changes in the stock distribution or changes in the harvest pattern of the net fisheries.

Vedder-Chilliwack and Salmon coho were similarly distributed in the 1979 harvest. Distributions were also similar in the hook and line fisheries and the net fisheries at the north and south approaches to the Strait of Georgia. This indicated that the stocks reared in similar proportions in outside waters and returned to the river by similar routes. Vedder-Chilliwack and upper Chilliwack coho, however, had different distributions

Table 31. Summary of percent harvest distribution of the study stocks among the major fisheries, by stock and brood year. [a]

System	Dominant brood year	North and central coast troll	West coast of Vancouver Island troll	Strait of Georgia troll	Strait of Georgia sport	British Columbia net	Puget Sound sport and net	Washington/ Oregon sport and troll
Vedder-Chilliwack River	1974	0.2%	22.7%	17.3%	24.0%	14.2%	12.7%	8.9%
	1975	1.4%	9.6%	34.5%	39.7%	4.7%	6.3%	3.7%
	1976	2.6%	13.3%	27.7%	43.9%	3.5%	4.5%	3.3%
	Mean	1.4%	15.2%	26.5%	35.9%	7.4%	7.8%	5.3%
Upper Chilliwack River	1975	1.7%	16.9%	27.5%	28.2%	9.8%	10.1%	5.7%
	1976	2.3%	21.3%	19.0%	32.6%	4.7%	7.4%	11.2%
	1977	0.0%	27.0%	10.4%	26.2%	12.0%	19.5%	4.9%
	1978	5.6%	27.3%	4.9%	18.0%	16.0%	20.9%	6.9%
	Mean	2.4%	23.2%	15.4%	26.2%	10.6%	14.5%	7.2%
Salmon River	1976	0.5%	11.6%	28.1%	45.5%	4.6%	7.0%	1.8%
	1977	0.1%	17.0%	17.8%	36.8%	9.2%	14.9%	3.9%
	1978	4.3%	25.5%	10.0%	34.3%	13.3%	8.0%	4.4%
	Mean	1.6%	18.0%	18.6%	38.9%	9.0%	10.0%	3.4%
Upper Pitt River	1977	8.6%	37.6%	9.6%	15.9%	12.0%	12.3%	4.0%
	1978	5.3%	43.7%	5.8%	12.9%	15.6%	9.8%	6.5%
	1979	6.2%	46.3%	4.8%	12.2%	10.9%	12.2%	7.0%
	Mean	6.7%	42.5%	6.7%	13.6%	12.9%	11.4%	5.9%
Birkenhead River	1980	0.0%	75.3%	0.0%	13.4%	2.1%	9.3%	0.0%
	1981	1.4%	77.3%	1.6%	7.0%	4.6%	3.8%	4.2%
	Mean	0.7%	76.3%	0.8%	10.2%	3.3%	6.5%	2.1%
Campbell River	1980	8.0%	43.3%	0.8%	22.2%	10.2%	12.6%	1.6%
Salwein Creek [b]	1980	5.1%	12.8%	2.4%	66.6%	7.1%	4.7%	1.4%

[a] Based on estimated CWT harvest.
[b] From Schubert and Lister (1986).

Table 32. Summary of percent harvest of study stocks by gear type, location and nation, by stock and brood year. [a]

Stock	Brood year	Percent of harvest			Percent of harvest		Percent of harvest		Percent of harvest	
		Sport	Troll	Net	Inside	Outside	North approach	South approach	Canada	U.S.
Vedder-Chilliwack River	1974	26.8%	47.5%	25.7%	57.2%	42.8%	34.8%	65.2%	78.4%	21.6%
	1975	41.3%	48.1%	10.6%	83.2%	16.8%	68.5%	31.5%	90.0%	10.0%
	1976	46.6%	47.5%	5.8%	79.0%	21.0%	34.1%	65.9%	92.2%	7.8%
	Mean	38.2%	47.7%	14.0%	73.1%	26.9%	45.8%	54.2%	86.9%	13.1%
Upper Chilliwack River	1975	29.0%	51.6%	19.1%	70.7%	29.3%	13.5%	86.5%	84.2%	15.8%
	1976	33.3%	54.7%	12.0%	59.6%	40.4%	61.5%	38.5%	81.4%	18.6%
	1977	26.4%	42.1%	31.5%	52.3%	47.7%	45.2%	54.8%	75.6%	24.4%
	1978	19.1%	44.0%	36.9%	35.6%	64.4%	31.5%	68.5%	72.2%	27.8%
	Mean	27.0%	48.1%	24.9%	54.6%	45.5%	37.9%	62.1%	78.4%	21.7%
Salmon River	1976	48.8%	42.5%	8.7%	84.6%	15.4%	45.3%	54.7%	91.2%	8.8%
	1977	39.1%	38.1%	22.9%	72.5%	27.5%	30.4%	69.6%	81.2%	18.8%
	1978	36.0%	43.7%	20.4%	56.8%	43.2%	63.4%	36.6%	87.6%	12.4%
	Mean	41.3%	41.4%	17.3%	71.3%	28.7%	46.4%	53.6%	86.7%	13.3%
Upper Pitt River	1977	17.9%	59.4%	22.7%	35.4%	64.6%	43.5%	56.5%	83.7%	16.3%
	1978	15.1%	61.1%	23.8%	26.8%	73.2%	38.2%	61.8%	83.6%	16.4%
	1979	14.5%	63.2%	22.3%	23.0%	77.0%	37.9%	62.1%	80.8%	19.2%
	Mean	15.8%	61.2%	22.9%	28.4%	71.6%	39.9%	60.1%	82.7%	17.3%
Birkenhead River	1980	17.5%	75.3%	7.2%	18.9%	81.1%	17.6%	82.4%	90.7%	9.3%
	1981	10.9%	82.0%	7.0%	10.6%	89.4%	100.0%	0.0%	92.0%	8.0%
	Mean	14.2%	78.7%	7.1%	14.8%	85.3%	58.8%	41.2%	91.4%	8.6%
Campbell River	1980	26.4%	53.6%	20.0%	32.6%	67.4%	78.4%	21.6%	85.8%	14.2%
Salwein Creek [b]	1980	52.7%	39.5%	7.9%	65.4%	34.6%	89.2%	10.8%	96.7%	3.3%

[a] Based on estimated CWT harvest.
[b] From Schubert and Lister (1986).

(1978-79 harvest), with the proportion of Vedder-Chilliwack coho harvested in the Strait of Georgia exceeding that of upper Chilliwack coho by more than 17 percentage points.

The survival of Vedder-Chilliwack coho, both to harvest (19.0%) and in total (24.1%), was the highest among the study stocks (Table 33). These survivals were atypical of other stocks tagged as smolts and of Vedder-Chilliwack coho in later years. Survivals of other stocks were 7-11 percentage points less to harvest and 8-12 percentage points less in total (Table 33); however, direct within year comparisons could not be made. Although estimates were available for 1976 brood Vedder-Chilliwack and Salmon coho, Salmon coho survival was artificially depressed by smolt mortality at a pumphouse at the river mouth.

Salwein coho made up an average 39% of the Vedder-Chilliwack CWT groups (Fedorenko and Cook 1982). The survival of 1980 brood Salwein coho, therefore, may provide an indicator of survival in the Vedder-Chilliwack system. The 1980 brood survival to harvest and total survival was 7.4 and 8.2 percentage points less, respectively, than for 1974-76 brood Vedder-Chilliwack coho. The reason for apparent changes of this magnitude are unknown. It is clear, however, that unless a recent systematic negative bias has occurred in the coast-wide head recovery system, survivals of 1974-76 brood Vedder-Chilliwack coho were unusually high.

The exploitation rate of Vedder-Chilliwack coho averaged 78.6%; however, annual estimates incorporated several potential sources of error. Escapement included a component (22%) based on the subjective manipulation of visual data (Schubert and Fleming 1989). Such estimates will underestimate true escapement unless there was an unusual positive bias in the visual counts (Cousens et al. 1982). On the other hand, Vedder-Chilliwack coho were harvested in a terminal sport fishery and in an Indian food fishery in the lower Fraser River. Harvest in these fisheries was underestimated due to an absence of expansion factors and harvest estimates, respectively; however, the low probable harvest rate in these fisheries made this source of bias small. The exploitation rate estimate for Vedder-Chilliwack coho, therefore, may have a positive bias of unknown magnitude, while the total survival may be underestimated. Caution is urged, therefore, when comparing these parameters between brood years and stocks.

UPPER CHILLIWACK RIVER

Upper Chilliwack coho had a variable marine distribution. Strait of Georgia fisheries harvested from 23% to 56% of the annual total (Table 31), while harvest by the inside hook and line fisheries ranged from 36% to 71% of the hook and line harvest (Table 32). A progressive decline was noted in the apparent residency in the Strait of Georgia and, while the proportion of harvest taken in the west coast of Vancouver Island troll fishery increased over the study period, little change was noted between the 1977 and 1978 brood years despite a pronounced outside distribution for the latter brood year.

Upper Chilliwack and upper Pitt coho were similarly distributed, reared in similar proportions in outside waters and returned to the river by similar routes (1981). Upper Chilliwack and both Vedder-Chilliwack (1978-79) and Salmon (1979-81) coho, however, had different distributions. The proportion of the Vedder-Chilliwack and Salmon stocks harvested in the Strait of Georgia exceeded that of upper Chilliwack coho by more than 17 percentage points, although the difference between upper Chilliwack

Table 33. Summary of estimated annual survival and exploitation rate of study coho stocks.

System	Dominant brood year	Age at release	Survival (%) To harvest	Survival (%) Total	Exploitation rate (%)
Vedder-	1974	Smolt	21.0%	26.6%	78.9%
Chilliwack River	1975	Smolt	17.4%	22.6%	76.7%
	1976	Smolt	18.5%	23.2%	80.1%
	Mean	Smolt	19.0%	24.1%	78.6%
Salmon River	1976	Smolt	8.4%	15.6%	53.5%
	1977	Smolt	11.1%	17.7%	62.7%
	1978	Smolt	9.5%	12.3%	77.2%
	Mean	Smolt	9.7%	15.2%	64.5%
Campbell River	1980	Smolt	10.2%	16.3%	62.6%
Salwein Creek [a]	1980	Smolt	11.6%	15.9%	72.6%
Upper	1975	0+ fry	4.5%	5.2%	86.6%
Chilliwack River	1976	0+ fry	5.2%	7.0%	74.8%
	1977	0+ fry	3.6%	4.1%	88.3%
	1978	0+ fry	1.9%	2.3%	82.0%
	Mean	0+ fry	3.8%	4.7%	82.9%
Upper Pitt River	1978	0+ fry	2.7%	3.3%	82.1% [b]
	1979	0+ fry	2.4%	3.1%	78.1% [b]
	Mean	0+ fry	2.6%	3.2%	80.1% [b]
	1977	1+ fry	4.4%	5.9%	74.4% [c]
	1978	1+ fry	3.9%	5.9%	66.3% [c]
	Mean	1+ fry	4.2%	5.9%	70.4% [c]
Birkenhead River	1981	0+ fry	2.9%	3.7%	77.6%
	1980 [d]	1+ fry	3.1%	4.1%	75.8%
	Combined	-	2.9%	3.7%	77.5%
Mean					
- Smolt release			13.5%	18.8%	70.5%
- Age 0+ fry release			3.3%	4.1%	81.4%
- Age 1+ fry release			3.8%	5.3%	72.2%
- Total			-	-	75.0%

[a] From Schubert and Lister (1988).
[b] Harvest and escapement at age 3_2 and 4_3
[c] Harvest and escapement at age 4_3 only.
[d] Large error in age at release. Predominantly 1981 brood.

and Salmon coho was not statistically significant in 1980. In 1981, Vedder-Chilliwack and upper Chilliwack coho also returned to the river from outside waters using different migratory routes.

The survival of upper Chilliwack coho to harvest (3.8%) and in total (4.7%) was among the highest of the study stocks released at age 0+, and showed the largest range (Table 33). Similarly, the estimated exploitation rate (82.9%) was the highest of the study stocks; however, the exploitation rate estimates incorporated several potential sources of error. Like the Vedder-Chilliwack stock, the harvest of upper Chilliwack coho may have been underestimated due to poor assessment of the terminal sport and Indian food fisheries. However, the greatest potential error arises from the quality of the escapement estimates. Total escapement, estimated subjectively from limited visual data, was applied to visual estimates of mark ratios, often without dissection results, to estimate escapement by CWT code. Extreme caution is urged when comparing these parameters between brood years and stocks.

SALMON RIVER

Salmon coho had a high apparent residency in the Strait of Georgia. Strait of Georgia fisheries harvested 44% to 74% of the annual total (Table 31), while harvest by the inside hook and line fisheries ranged from 57% to 85% of the hook and line harvest (Table 32). Annual harvest by fishery was variable, with a trend toward increased harvest in outside fisheries over the study period.

The distribution of Salmon coho was similar to Vedder-Chilliwack coho (1979), but differed from upper Chilliwack (1979-81) and upper Pitt (1981) coho, the latter stocks having a less pronounced inside distribution. The proportion of Salmon coho harvested in the Strait of Georgia exceeded that of upper Chilliwack and upper Pitt coho by at least 17 and 27 percentage points, respectively. Differences in the hook and line fisheries and the net fisheries at the north and south approaches to the Strait of Georgia indicated that Salmon coho reared in different proportions in outside waters and returned to the river by different routes. Salmon and Vedder-Chilliwack coho had different seasonal patterns in the Strait of Georgia sport fishery. These were the only stocks to show such a difference.

The survival to harvest of Salmon coho (9.7%) was the lowest among the study stocks tagged as smolts (Table 33). Low survivals may reflect smolt mortalities of 26% to 31% recorded at the pumphouse at the river mouth (Russell MS 1981). Unfortunately, the pump was automated and, due to variable annual freshet timing, operated for different periods each year. It was not possible to adjust survival estimates to compensate for this factor.

The exploitation rate of Salmon coho averaged only 64.5%, with a trend of increasing rates over the study period (Table 33). Potential error in these estimates resulted almost entirely from uncertainty in escapement estimation arising from an inability to evaluate spawner residence time. Spawner residence time derived from the Vedder-Chilliwack study (Schubert and Fleming 1989) was less than one-half the values reported in the literature (e.g. Crone and Bond 1976; Flint and Zillges 1980). If the true residence time approached literature values, the result would be a large positive bias in the escapement and total survival estimates and a underestimation of the exploitation rate. Caution is urged in comparing these parameters between brood years and stocks.

UPPER PITT RIVER

Upper Pitt coho had a very low apparent residency in the Strait of Georgia. Strait of Georgia fisheries harvested from 17% to 26% of the annual total (Table 31), while harvest by the inside hook and line fisheries ranged from 23% to 35% of the hook and line harvest (Table 32). A progressive decline was noted in the study period harvest by the Strait of Georgia fisheries, with an increase in the proportion of harvest taken in the west coast of Vancouver Island troll fishery.

The distribution of Upper Pitt coho was similar to upper Chilliwack (1981) and Campbell (1983) coho, but differed from Salmon (1981) and Salwein (1983) coho, the latter having a more pronounced inside distribution. The proportion of Salmon and Salwein coho harvested in the Strait of Georgia exceeded that of upper Pitt coho by 27 and 42 percentage points, respectively. Upper Pitt and Salmon coho also differed in apparent route of return from outside waters, with a higher proportion of the Salmon stock taken in the north approach.

Consecutive broods of upper Pitt River coho harvested in the same year had similar distributions; however, little difference was noted in the distribution of harvest between years. No conclusions could be drawn, therefore, about the role of genetic versus environmental influence in determining the marine distribution of this stock.

The survival of age 0+ release upper Pitt coho to harvest (2.6%) and in total (3.2%) was somewhat less than for comparable releases in the upper Chilliwack and Birkenhead rivers (Table 33). The survival of upper Pitt coho released at age 1+, however, was almost double that of the age 0+ groups. This difference probably reflects the overwinter survival advantage conferred by a larger average body size.

Exploitation rates averaged 80.1% and 70.4% for upper Pitt coho coded wire tagged at age 0+ and 1+, respectively. When the life history of upper Pitt coho is considered, this difference was unexpected. A typical upper Pitt coho brood remains in fresh water for one year, smolts the following spring and is vulnerable to the fishery from the fall of their first ocean year until maturity at age 3_2 the following fall. At least 80% of the adults showed this pattern. A component of the stock remains in fresh water a second year, smolts one year later than the main group, and is again vulnerable to the fishery for about one year before maturing at age 4_3. While a single brood is harvested in two years, it is a discrete component of the brood which is harvested each year. Exploitation rates, therefore, would not be cumulative over two years and, given the similar within year, between brood harvest distributions, would be expected to be identical for the age 4_3 component of one brood and the age 3_2 component of the subsequent brood year. This was not the case (Table 17). The exploitation rate difference may reflect the sample size of the coded wire tagged escapement of age 4_3. It is recommended, therefore, that only exploitation rates estimated for age 3_2 upper Pitt coho be used for comparative purposes.

BIRKENHEAD RIVER

Birkenhead coho had a very low apparent residency in the Strait of Georgia. Strait of Georgia fisheries harvested from 9% to 13% of the annual total (Table 31), while harvest by the inside hook and line fisheries ranged from 11% to 19% of the hook and line total (Table 32). Over three-quarters of the harvest occurred in the west coast of Vancouver Island troll fishery, the most pronounced apparent outside distribution among the study

stocks. No other stocks were tagged in this brood.

The survival of age 0+ releases of Birkenhead coho to harvest (2.9%) and in total (3.7%) was similar to that reported for upper Pitt coho (Table 33). Differences were noted in the age 1+ releases, probably reflecting error in the age discrimination of Birkenhead coho juveniles. Schubert et al. (1985) estimated up to 83% of the 1980 brood release were actually from the 1981 brood. For comparative purposes, therefore, we combined the two release groups to estimate survivals and exploitation rate of Birkenhead coho (Table 21).

The exploitation rate of Birkenhead coho averaged 77.5% (Table 33). This estimate incorporated two potential sources of error. First, the harvest of Birkenhead coho was underestimated due to poor assessment of the terminal fisheries. Expansion factors were unavailable for the 1984 Indian food fishery, despite a harvest almost 2,000 coho in the Lillooet River System (Schubert 1985). Harvest estimates were not available for the sport fishery. Second, while the escapement estimate was considered sound, mark-recapture studies tend to overestimate escapement (Simpson 1984). These factors would probably introduce a negative bias in both survival and exploitation rate estimates. For comparative purposes, estimates for these parameters should be considered minima.

CAMPBELL RIVER

Campbell coho had a low apparent residency in the Strait of Georgia. Strait of Georgia fisheries harvested 23% of the annual total (Table 31), while harvest by the inside hook and line fisheries was 33% of the hook and line harvest (Table 32).

Campbell and upper Pitt coho were similarly distributed in the 1983 harvest, apparently reared in similar proportions in outside waters and returned to the river by similar routes. Campbell and Salwein coho, however, had different distributions. The proportion of the Salwein stock harvested in the Strait of Georgia exceeded that of Campbell coho by 36 percentage points.

The survival of Campbell coho to harvest (10.2%) and in total (16.3%) was almost identical to that estimated for Salwein coho (Table 33). The exploitation rate (62.6%), however, was among the lowest estimated for any stock and was 10 percentage points lower than that estimated for Salwein coho in the same year. While error may have resulted from poor assessment of a small sport fishery in the lower part of the river, it is also probable that escapement was underestimated when high flows overtopped the fence (Schubert and Fleming 1989). Survival, therefore, may be underestimated while exploitation rate should be considered a maximum.

SALWEIN CREEK

Salwein coho had a high apparent residency in the Strait of Georgia. Strait of Georgia fisheries harvested 69% of the annual total (Table 31), while harvest by the inside hook and line fisheries was 65% of the hook and line harvest (Table 32). While Salwein coho were tagged only in one year, they made up an average 39% of the Vedder-Chilliwack coho release groups; therefore, between year comparisons are appropriate. General harvest distributions were similar; however, a difference was noted in the proportion of harvest by fishery within the Strait of Georgia. The proportion of the stock harvested in the Strait of Georgia troll fishery declined by 16 percentage points, while the proportion harvested by the sport fishery increased by 10 percentage points.

The distribution of Salwein coho differed from both Campbell and upper Pitt coho in 1983. The proportion of Salwein coho harvested in the Strait of Georgia exceeded that of Campbell and upper Pitt coho by at least 36 percentage points.

The survival of Salwein coho to harvest (11.6%) and in total (15.9%) was almost identical to that estimated for Campbell coho (Table 33). The exploitation rate (72.6%), however, was considerably higher than that estimated for Campbell coho in the same year. As noted for Vedder-Chilliwack coho, harvest was underestimated due to poor assessment of the Indian food fishery; however, the Salwein study did estimate harvest in the sport fishery, the major terminal fishery. Escapement was estimated from a mark-recapture study and may have a positive bias. These biases, however, are thought to be minor.

GENERAL

Harvest Distribution

Geographic: The distribution of the study stock harvest was relatively homogeneous, with the majority occurring in southern British Columbia waters, i.e. Georgia, Johnstone and Juan de Fuca straits and the west coast of Vancouver Island. On average, less than 8% (range 0% to 13.5%) of the harvest occurred north of Vancouver Island and south of Juan de Fuca Strait (Table 31). Within this area, however, there was considerable variability in the degree of harvest and presumably the degree of residency in the Strait of Georgia. For example, the proportion of the total harvest occurring in the Strait of Georgia fisheries ranged from as low as 9% in Birkenhead coho to as high as 74% in Salmon coho, a 65 percentage point difference. Variability was greater between rather than within stocks. For example, the proportion of the annual harvest in the Strait of Georgia varied by 33 percentage points in Vedder-Chilliwack and upper Chilliwack coho and by only 9 percentage points in upper Pitt coho. This suggests that marine distribution was an inherent trait but the degree to which that trait was expressed was determined by annual environmental factors.

Annual trends in the distribution of harvest among the hook and line fisheries suggest a general decline in residency within the Strait of Georgia between 1978-83 (Fig. 10); however, trends were difficult to evaluate because no single stock was tagged for more than four years.

Distributional differences between study stocks are shown in a dendogram (Fig. 11). Stocks were grouped based on G-test results, with similar stocks clustered and stocks with significant differences separated. The degree of between stock difference was represented by the sum of the percent difference in distribution in each harvest region. When available, within year comparisons were made; otherwise, average distributions were used. For stock groups, the average distribution of the group was used. Stocks for which within year statistical comparisons of harvest distribution were unavailable were shown by a dotted line.

The study stocks fell into two general groups. Birkenhead, Campbell, upper Pitt and upper Chilliwack coho all tended to have pronounced outside distributions which, when statistical comparisons were available, were significantly different from the other stocks. Salwein, Salmon and Vedder-Chilliwack coho all had pronounced inside distributions, with the latter two stocks the most closely related of the study stocks.

User Group: The troll fisheries

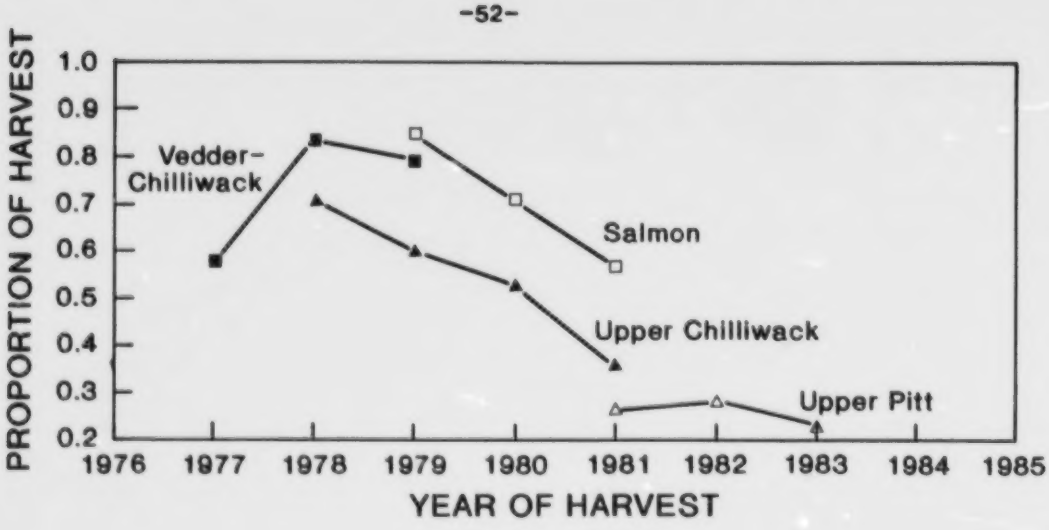

Figure 10 Proportion of the hook and line fishery harvest taken in the Strait of Georgia

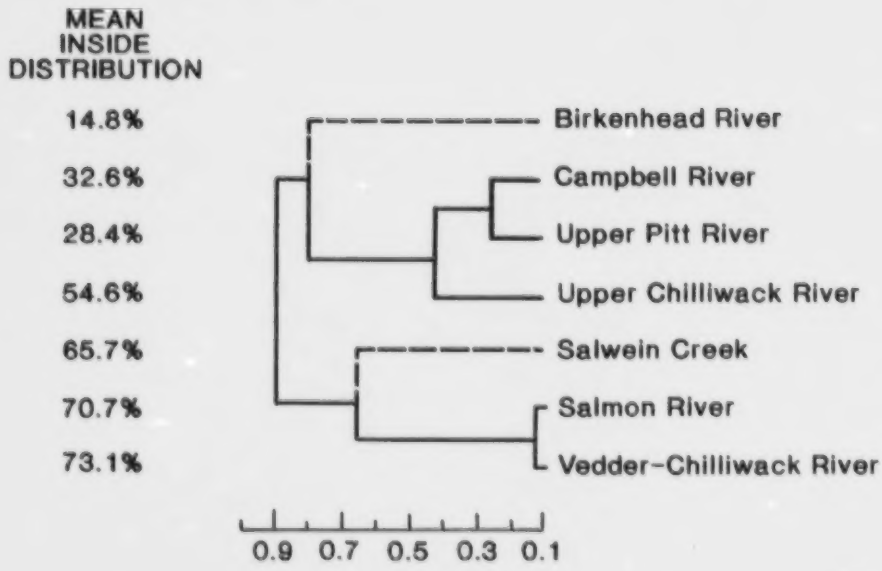

Figure 11 Dendogram of similarities in harvest distribution among the study stocks

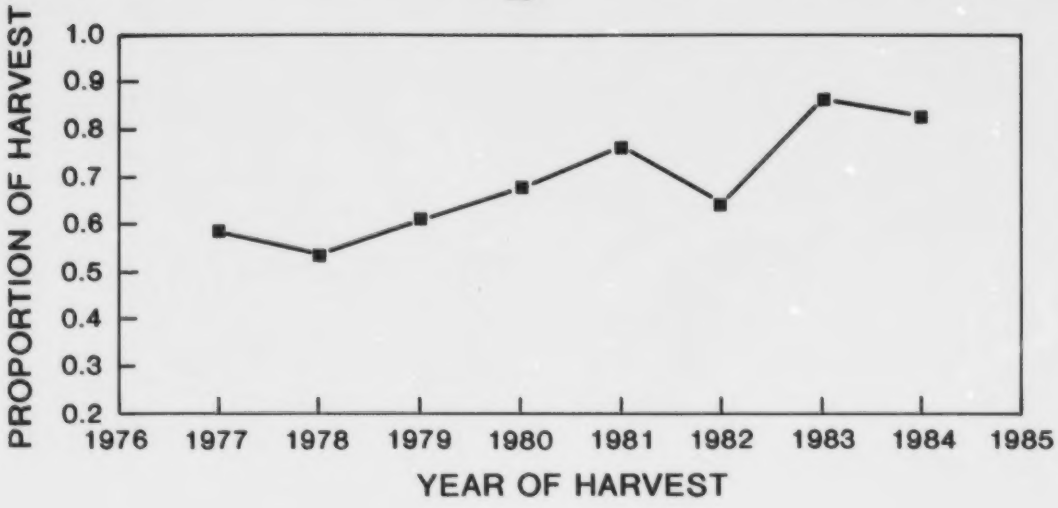

Figure 12 Proportion of the Strait of Georgia study stock harvest taken by the sport fishery

were the largest harvester of study area coho salmon, averaging 52.6% of the total harvest, followed by the sport (29.5%) and net (17.9%) fisheries (Table 32). Considerable variability was noted between stocks and years. Variability was related both to annual changes in fishing plans, especially in the net fisheries, and to the marine distribution of the stock. Stocks with a high apparent residency in the Strait of Georgia, Salwein, Salmon and Vedder-Chilliwack coho, had over double the proportion harvested by the sport fishery (44%) compared to those with outside distributions (21%). Fisheries in the United States of America harvested an average 15% of the study stock total (unweighted), with a range of 3% (Salwein coho) to 28% (upper Chilliwack coho) (Table 32).

We did not attempt to relate study stock harvest pattern changes to annual management actions; however, we did examine the changing impact of the two major fisheries within the Strait of Georgia. The total harvest of all study stocks within the Strait of Georgia was summed by year to calculate the annual proportion harvested by the sport and troll fisheries. There was a progressive increase, from 59% to 83%, in the proportion of the study stock harvest taken by the sport fishery (Fig. 12). This change probably reflects a combination of reduced troll effort in the Strait of Georgia due to regulation changes such as the implementation of two area licensing in 1981 (Argue et al. 1987) and increases in sport effort (Shardlow and Hoyt 1985).

Seasonal: Seasonal harvest patterns in the west coast of Vancouver Island troll and Strait of

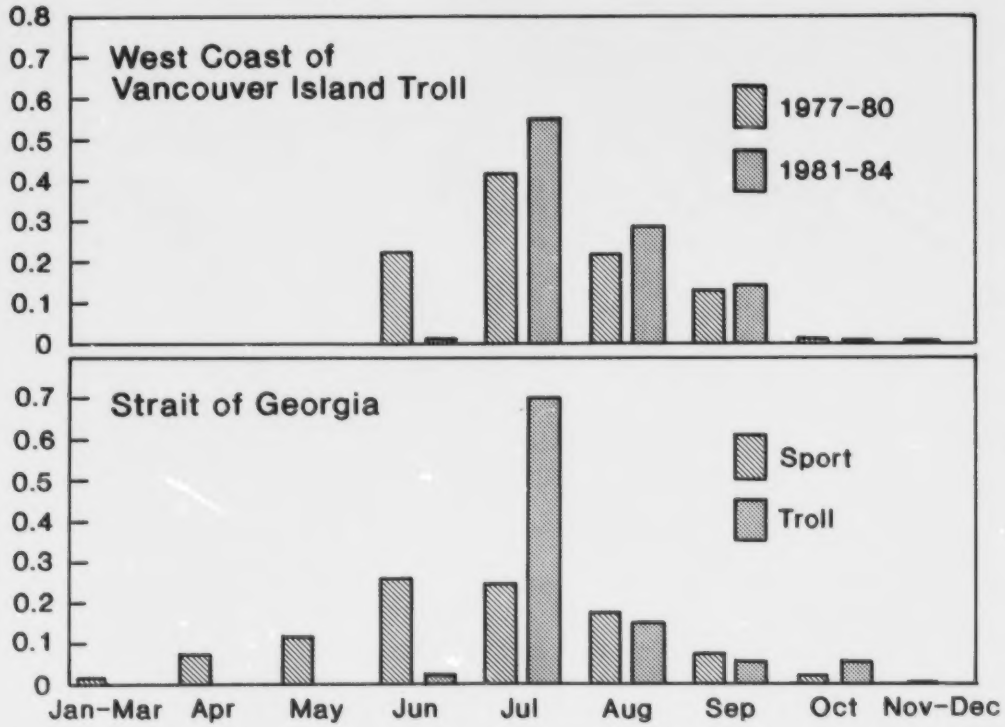

Figure 13 Generalized seasonal pattern of study stock harvest in the west coast of Vancouver Island troll and Strait of Georgia sport and troll fisheries

Georgia sport and troll fisheries are shown in Figure 13. Because most study stocks were similar, a generalized pattern was used. The troll fisheries had a high early season harvest followed by rapid decreases through August and September. Before 1981, harvest occurred in June because the west coast of Vancouver Island troll fishery opened on June 15. Although harvest was not as large as in July, this reflected the shorter fishing period in that month. Troll effectiveness peaks at season opening and declines through the remainder of the season (Argue et al. 1987).

The sport fishery, which was not restricted by season, reported harvest every month of the year. In all cases, harvest was greatest in June, July and August, which accounted for over two-thirds of the harvest. Peak harvest occurred in either June or July, depending upon the stock.

Exploitation Rate

The estimation of exploitation rates for the study stocks was often hampered by the quality of the escapement estimates. Data quality was poorest in the Vedder-Chilliwack,

upper Chilliwack and Salmon River studies; therefore, exploitation rate estimates for those stocks were of limited reliability. Escapement estimates for upper Pitt, Campbell and Birkenhead river and Salwein Creek coho were considered sufficiently reliable for use in exploitation rate estimation. Exploitation rates for those stocks averaged 74.6%. The highest exploitation rates were for upper Pitt coho (78.1% to 82.1%), with the lowest for Campbell River coho (62.6%). Except for the Campbell River, these estimates were notable in that all exceed 70%, the level thought to be associated with the maximum sustainable harvest of southern British Columbia coho salmon (DFO MS 1987). This suggests that most lower Fraser River area stocks were overharvested through the early 1980's.

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Appendices

Appendix 1a. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 15 13).

Fishery	Location		1977 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	6	2	24	28	47	83	29	1	-	-	-	220
		Est:	-	24	8	96	112	188	332	116	4	-	-	-	880
	Puget Sound	Obs:	-	-	-	-	2	-	-	4	4	-	-	-	10
		Est:	-	-	-	-	10	-	-	17	16	-	-	-	43
	Washington/Oregon	Obs:	-	-	-	-	-	4	5	2	1	-	-	-	12
		Est:	-	-	-	-	-	18	21	15	6	-	-	-	60
Troll	South Central	Obs:	-	-	-	-	-	1	3	2	1	-	-	-	7
		Est:	-	-	-	-	-	1	3	2	1	-	-	-	7
	West Vancouver Island	Obs:	-	-	-	-	-	38	35	42	22	10	-	-	147
		Est:	-	-	-	-	-	174	197	276	161	27	-	-	835
	Georgia Strait	Obs:	-	-	-	-	-	-	201	81	50	7	-	-	339
		Est:	-	-	-	-	-	-	396	133	92	17	-	-	638
	Washington/Oregon	Obs:	-	-	-	-	-	-	37	23	9	-	-	-	69
		Est:	-	-	-	-	-	-	146	88	34	-	-	-	268
Net	Northern	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	6	-	-	-	-	6
	Central	Obs:	-	-	-	-	-	-	1	3	1	-	-	-	5
		Est:	-	-	-	-	-	-	4	16	6	-	-	-	26
	Southwest Vanc. Is.	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	1	-	-	-	-	-	-	1
	Johnstone Strait	Obs:	-	-	-	-	-	-	18	6	15	-	-	-	39
		Est:	-	-	-	-	-	-	58	34	79	-	-	-	171
	Juan de Fuca	Obs:	-	-	-	-	-	2	4	22	35	13	-	-	76
		Est:	-	-	-	-	-	14	9	89	113	68	-	-	293
	Georgia Strait	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	1	-	-	-	-	1
	Puget Sound	Obs:	-	-	-	-	-	1	5	19	70	83	-	-	178
		Est:	-	-	-	-	-	3	12	44	187	178	-	-	424
	Fraser River	Obs:	-	-	-	-	-	-	1	-	1	1	-	-	3
		Est:	-	-	-	-	-	-	9	-	8	6	-	-	23
Total		Obs:	0	6	2	24	30	94	393	235	210	114	0	0	1108
		Est:	0	24	8	96	122	399	1187	837	707	296	0	0	3676

Appendix 1a. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 15 13).

Fishery	Location		1978 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	4	-	-	-	-	4
Total		Obs:	0	0	0	0	0	0	0	1	0	0	0	0	1
		Est:	0	0	0	0	0	0	0	4	0	0	0	0	4

Appendix 1b. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 04 13).

Fishery	Location		1977 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	1	-	-	5	1	7
		Est:	-	-	-	-	-	-	-	4	-	-	20	4	28
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Net	Puget Sound	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
Total		Obs:	0	0	0	0	0	0	0	1	2	0	5	1	9
		Est:	0	0	0	0	0	0	0	4	6	0	20	4	34

Appendix 1b. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 04 13).

Fishery	Location		1978 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	1	-	14	27	36	48	83	65	35	26	10	1	346
		Est:	4	-	56	108	144	192	332	260	140	104	40	4	1384
	Puget Sound	Obs:	-	-	-	-	-	-	-	1	1	-	-	-	2
		Est:	-	-	-	-	-	-	-	6	7	-	-	-	12
	Washington/Oregon	Obs:	-	-	-	-	-	3	3	4	1	-	-	-	11
		Est:	-	-	-	-	-	10	11	17	5	-	-	-	43
Troll	North Central	Obs:	-	-	-	-	-	-	1	2	-	-	-	-	3
		Est:	-	-	-	-	-	-	2	5	-	-	-	-	7
	South Central	Obs:	-	-	-	-	-	3	3	1	1	-	-	-	8
		Est:	-	-	-	-	-	24	11	8	1	-	-	-	44
	West Vancouver Island	Obs:	-	-	-	-	-	22	17	4	18	-	-	-	61
		Est:	-	-	-	-	-	101	131	20	94	-	-	-	346
	Georgia Strait	Obs:	-	-	-	-	-	69	319	102	80	-	-	-	570
		Est:	-	-	-	-	-	184	735	178	140	-	-	-	1238
	Washington/Oregon	Obs:	-	-	-	-	-	1	15	5	2	-	-	-	23
		Est:	-	-	-	-	-	3	52	24	12	-	-	-	91
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	2	7	20	1	-	-	30
		Est:	-	-	-	-	-	-	4	17	51	2	-	-	74
	Juan de Fuca	Obs:	-	-	-	-	-	-	2	-	4	6	-	-	12
		Est:	-	-	-	-	-	-	4	-	16	14	-	-	34
	Georgia Strait	Obs:	-	-	-	-	-	-	-	1	-	6	-	-	7
		Est:	-	-	-	-	-	-	-	2	-	9	-	-	11
	Puget Sound	Obs:	-	-	-	-	-	-	3	6	18	31	6	-	64
		Est:	-	-	-	-	-	-	6	14	47	96	44	-	207
	Fraser River	Obs:	-	-	-	-	-	-	-	1	4	10	-	-	15
		Est:	-	-	-	-	-	-	-	2	11	38	-	-	50
Total		Obs:	1	0	14	27	36	146	448	199	184	80	16	1	1152
		Est:	4	0	56	108	144	514	1288	553	524	263	84	4	3541

Appendix 1b. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 04 13).

Fishery	Location		1979 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	1	-	-	-	-	-	-	-	1	-	1	-	3
		Est:	4	-	-	-	-	-	-	-	4	-	4	-	12
Net	Puget Sound	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	1	-	-	-	-	-	1
Total		Obs:	1	0	0	0	0	0	1	0	1	0	1	0	4
		Est:	4	0	0	0	0	0	1	0	4	0	4	0	13

Appendix 1c. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 21 24).

Fishery	Location		1978 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	1	-	1	2	1	15	-	20
		Est:	-	-	-	-	-	4	-	4	8	4	60	-	80
Total		Obs:	0	0	0	0	0	1	0	1	2	1	15	0	20
		Est:	0	0	0	0	0	4	0	4	8	4	60	0	80

Appendix 1c. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 21 24).

Fishery	Location		1979 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	1	-	5	34	49	142	129	126	67	37	30	-	620
		Est:	4	-	20	136	196	568	516	504	268	148	120	-	2480
	Puget Sound	Obs:	-	-	1	1	-	3	7	7	1	-	-	-	20
		Est:	-	-	6	3	-	17	40	54	4	-	-	-	124
	Washington/Oregon	Obs:	-	-	-	-	-	3	3	4	-	-	-	-	10
		Est:	-	-	-	-	-	10	10	17	-	-	-	-	37
	Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	1	-	-	-	-	-	1
Troll	North Central	Obs:	-	-	-	-	-	2	2	-	-	-	-	-	4
		Est:	-	-	-	-	-	4	4	-	-	-	-	-	8
	South Central	Obs:	-	-	-	-	-	2	9	8	2	-	-	-	21
		Est:	-	-	-	-	-	8	40	79	18	-	-	-	146
	West Vancouver Island	Obs:	-	-	-	-	-	11	60	28	13	-	-	-	112
		Est:	-	-	-	-	-	44	385	235	112	-	-	-	776
	Georgia Strait	Obs:	-	-	-	-	1	-	397	136	123	3	-	-	660
		Est:	-	-	-	-	1	-	1125	259	230	5	-	-	1620
	Washington/Oregon	Obs:	-	-	-	-	-	-	21	19	1	-	-	-	41
		Est:	-	-	-	-	-	-	77	74	3	-	-	-	155
	Miscellaneous	Obs:	-	-	-	-	-	-	20	-	-	-	-	-	20
		Est:	-	-	-	-	-	-	72	-	-	-	-	-	72
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	10	5	12	-	-	-	27
		Est:	-	-	-	-	-	-	17	25	32	-	-	-	75
	Juan de Fuca	Obs:	-	-	-	-	-	-	1	17	16	-	-	-	34
		Est:	-	-	-	-	-	-	1	64	53	-	-	-	117
	Puget Sound	Obs:	-	-	-	-	-	-	12	19	6	9	-	-	46
		Est:	-	-	-	-	-	-	26	62	26	25	-	-	139
	Fraser River	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	10	-	-	-	-	10
Total		Obs:	1	0	6	35	50	163	672	370	241	49	30	0	1617
		Est:	4	0	26	139	197	651	2314	1383	746	178	120	0	5760

Appendix 1c. Observed and estimated recoveries of Vedder-Chilliwack River coho salmon (code 02 21 24).

Fishery	Location		1980 Catch by month												Total
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sport	Georgia Strait	Obs:	-	-	1	1	-	-	-	-	-	-	-	-	2
		Est:	-	-	4	4	-	-	-	-	-	-	-	-	8
Troll	Georgia Strait	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	2	-	-	-	-	2
	Washington/Oregon	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	4	-	-	-	-	-	4
Total		Obs:	0	0	1	1	0	0	1	1	0	0	0	0	4
		Est:	0	0	4	4	0	0	4	2	0	0	0	0	14

Appendix 2a. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 15 11).

Fishery	Location		1978 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	5	8	9	11	12	12	6	1	1	-	65
		Est:	-	-	20	32	36	44	48	48	24	4	4	-	260
	Puget Sound	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	4	-	-	-	-	4
	Washington/Oregon	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	3	-	-	-	-	-	-	3
Troll	North Central	Obs:	-	-	-	-	-	-	2	1	-	-	-	-	3
		Est:	-	-	-	-	-	-	3	2	-	-	-	-	5
	South Central	Obs:	-	-	-	-	-	1	2	-	-	-	-	-	3
		Est:	-	-	-	-	-	5	6	-	-	-	-	-	11
	West Vancouver Island	Obs:	-	-	-	-	-	16	4	5	3	-	-	-	28
		Est:	-	-	-	-	-	74	31	25	16	-	-	-	146
	Georgia Strait	Obs:	-	-	-	-	-	27	60	13	10	-	-	-	110
		Est:	-	-	-	-	-	76	138	22	18	-	-	-	254
	Washington/Oregon	Obs:	-	-	-	-	-	-	8	4	-	-	-	-	12
		Est:	-	-	-	-	-	-	27	23	-	-	-	-	50
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	-	-	2	-	-	-	2
		Est:	-	-	-	-	-	-	-	-	5	-	-	-	5
	Juan de Fuca	Obs:	-	-	-	-	-	-	1	2	5	1	-	-	9
		Est:	-	-	-	-	-	-	2	5	20	3	-	-	30
	Puget Sound	Obs:	-	-	-	-	-	-	-	2	27	3	-	-	32
		Est:	-	-	-	-	-	-	-	4	75	10	-	-	89
	Fraser River	Obs:	-	-	-	-	-	-	-	1	15	5	-	-	21
		Est:	-	-	-	-	-	-	-	5	35	15	-	-	55
Total		Obs:	0	0	5	8	9	56	89	41	68	10	1	0	287
		Est:	0	0	20	32	36	202	255	138	193	32	4	0	912

Appendix 2a. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 15 11).

Fishery	Location		1979 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Troll	Southwest Vancouver Is.	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	10	-	-	-	-	-	10
Total		Obs:	0	0	0	0	0	0	1	0	0	0	0	0	1
		Est:	0	0	0	0	0	0	10	0	0	0	0	0	10

Appendix 2b. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 21 20).

Fishery	Location		1979 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	1	2	9	4	3	2	-	-	-	21
		Est:	-	-	-	4	8	36	16	12	8	-	-	-	84
	Washington/Oregon	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	2	-	-	-	-	-	-	2
Troll	South Central	Obs:	-	-	-	-	-	-	1	1	-	-	-	-	2
		Est:	-	-	-	-	-	-	5	1	-	-	-	-	6
	West Vancouver Island	Obs:	-	-	-	-	-	1	4	3	-	-	-	-	8
		Est:	-	-	-	-	-	4	26	25	-	-	-	-	55
	Georgia Strait	Obs:	-	-	-	-	-	-	12	7	2	1	-	-	22
		Est:	-	-	-	-	-	-	33	11	4	2	-	-	49
	Washington/Oregon	Obs:	-	-	-	-	-	-	4	2	1	-	-	-	7
		Est:	-	-	-	-	-	-	16	9	3	-	-	-	27
	Miscellaneous	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	4	-	-	-	-	-	4
Net	Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	4	-	-	-	-	-	4
	Johnstone Strait	Obs:	-	-	-	-	-	-	-	1	2	-	-	-	3
		Est:	-	-	-	-	-	-	-	2	6	-	-	-	8
	Puget Sound	Obs:	-	-	-	-	-	-	-	2	1	1	-	-	4
		Est:	-	-	-	-	-	-	-	9	6	5	-	-	19
Total		Obs:	0	0	0	1	2	11	27	19	8	2	0	0	70
		Est:	0	0	0	4	8	42	104	69	26	7	0	0	258

Appendix 2c. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 21 30).

Fishery	Location		1979 Catch by month												Total
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	-	-	2	-	-	2
		Est:	-	-	-	-	-	-	-	-	-	8	-	-	8
Total		Obs:	0	0	0	0	0	0	0	0	0	2	0	0	2
		Est:	0	0	0	0	0	0	0	0	0	8	0	0	8

Appendix 2c. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 21 30).

Fishery	Location		1980 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	3	8	3	6	4	2	-	-	-	26
		Est:	-	-	-	12	32	7	37	19	14	-	-	-	121
	Washington/Oregon	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	1	-	-	-	-	-	-	1
Troll	West Vancouver Island	Obs:	-	-	-	-	-	6	15	3	1	-	-	-	25
		Est:	-	-	-	-	-	23	79	21	10	-	-	-	133
	Georgia Strait	Obs:	-	-	-	-	-	-	16	5	-	1	-	-	22
		Est:	-	-	-	-	-	-	35	13	-	3	-	-	51
	Washington/Oregon	Obs:	-	-	-	-	-	-	4	5	-	-	-	-	9
		Est:	-	-	-	-	-	-	13	9	-	-	-	-	23
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	3	3	1	-	-	-	7
		Est:	-	-	-	-	-	-	6	6	2	-	-	-	14
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	1	4	-	-	-	5
		Est:	-	-	-	-	-	-	-	2	13	-	-	-	15
	Georgia Strait	Obs:	-	-	-	-	-	-	-	2	-	-	-	-	2
		Est:	-	-	-	-	-	-	-	14	-	-	-	-	14
	Puget Sound	Obs:	-	-	-	-	-	-	1	2	22	11	-	-	36
		Est:	-	-	-	-	-	-	3	3	61	29	-	-	96
	Fraser River	Obs:	-	-	-	-	-	-	-	1	5	2	-	-	8
		Est:	-	-	-	-	-	-	-	2	9	5	-	-	16
Total		Obs:	0	0	0	3	8	10	45	26	35	14	0	0	141
		Est:	0	0	0	12	32	31	173	89	109	37	0	0	484

Appendix 2d. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 17 60).

Fishery	Location		1981 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	3	6	6	2	2	1	-	-	20
		Est:	-	-	-	-	8	22	26	9	8	4	-	-	77
	Washington/Oregon	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	3	-	-	-	3
	Freshwater	Obs:	-	-	-	-	-	-	-	-	1	1	-	-	2
		Est:	-	-	-	-	-	-	-	-	1	1	-	-	2
Troll	South Central	Obs:	-	-	-	-	-	-	3	-	1	-	-	-	4
		Est:	-	-	-	-	-	-	21	-	4	-	-	-	25
	West Vancouver Island	Obs:	-	-	-	-	-	-	6	8	1	-	-	-	15
		Est:	-	-	-	-	-	-	48	74	1	-	-	-	123
	Georgia Strait	Obs:	-	-	-	-	-	-	4	-	-	-	-	-	4
		Est:	-	-	-	-	-	-	22	-	-	-	-	-	22
	Washington/Oregon	Obs:	-	-	-	-	-	-	6	4	-	-	-	-	10
		Est:	-	-	-	-	-	-	16	12	-	-	-	-	28
Net	Johnstone Strait	Obs:	-	-	-	-	-	1	-	1	3	-	-	-	5
		Est:	-	-	-	-	-	2	-	9	12	-	-	-	23
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	1	9	-	-	-	10
		Est:	-	-	-	-	-	-	-	6	37	-	-	-	43
	Puget Sound	Obs:	-	-	-	-	-	-	1	1	16	6	-	-	24
		Est:	-	-	-	-	-	-	2	2	59	32	-	-	94
	Fraser River	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	6	-	-	-	6
Total		Obs:	0	0	0	0	3	7	26	17	35	8	0	0	96
		Est:	0	0	0	0	8	24	135	112	131	37	0	0	446

Appendix 2d. Observed and estimated recoveries of Upper Chilliwack River coho salmon (code 02 17 60).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	4	-	-	-	-	4
Total		Obs:	0	0	0	0	0	0	0	1	0	0	0	0	1
		Est:	0	0	0	0	0	0	0	4	0	0	0	0	4

Appendix 3a. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 16 52).

			1978 Catch by month											
Fishery	Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Total		Obs:	0	0	0	0	0	0	0	0	1	0	0	0	1
		Est:	0	0	0	0	0	0	0	0	4	0	0	0	4

Appendix 3a. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 16 52).

Fishery	Location		1979 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	4	17	21	20	33	15	3	-	1	114
		Est:	-	-	-	16	68	84	80	132	60	12	-	4	456
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	3	1	-	-	4
		Est:	-	-	-	-	-	-	-	-	26	4	-	-	30
	Washington/Oregon	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	4	-	-	-	-	-	-	4
Troll	South Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	5	-	-	-	-	-	5
	West Vancouver Island	Obs:	-	-	-	-	-	3	11	2	2	-	-	-	18
		Est:	-	-	-	-	-	12	71	17	17	-	-	-	117
	Georgia Strait	Obs:	-	-	-	-	-	-	69	28	23	-	-	-	120
		Est:	-	-	-	-	-	-	189	53	42	-	-	-	284
	Washington/Oregon	Obs:	-	-	-	-	-	-	2	2	-	-	-	-	4
		Est:	-	-	-	-	-	-	8	6	-	-	-	-	14
	Miscellaneous	Obs:	-	-	-	-	-	-	3	-	-	-	-	-	3
		Est:	-	-	-	-	-	-	10	-	-	-	-	-	10
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	6	1	3	-	-	-	10
		Est:	-	-	-	-	-	-	13	3	8	-	-	-	24
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	3	1	3	-	-	7
		Est:	-	-	-	-	-	-	-	13	3	7	-	-	23
	Puget Sound	Obs:	-	-	-	-	-	-	1	8	1	3	-	-	13
		Est:	-	-	-	-	-	-	1	28	6	6	-	-	41
Total		Obs:	0	0	0	4	17	25	113	77	48	10	0	1	295
		Est:	0	0	0	16	68	100	377	252	162	29	0	4	1008

Appendix 3b. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 16 59).

Fishery	Location		1979 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	1	-	-	-	1	-	-	1	-	3
		Est:	-	-	-	4	-	-	-	4	-	-	4	-	12
Total		Obs:	0	0	0	1	0	0	0	1	0	0	1	0	3
		Est:	0	0	0	4	0	0	0	4	0	0	4	0	12

Appendix 3b. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 16 59).

Fishery	Location		1980 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	1	133	36	60	67	59	14	7	1	-	258
		Est:	-	-	4	522	144	145	412	275	97	36	5	-	1170
	Puget Sound	Obs:	-	-	-	-	-	1	-	5	-	-	-	-	6
		Est:	-	-	-	-	-	3	-	38	-	-	-	-	41
	Washington/Oregon	Obs:	-	-	-	-	-	1	3	8	-	-	-	-	12
		Est:	-	-	-	-	-	3	7	21	-	-	-	-	31
	Central	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	1	-	-	-	-	1
Troll	Northern	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	4	-	-	-	-	-	4
	West Vancouver Island	Obs:	-	-	-	-	-	17	67	10	6	-	-	-	100
		Est:	-	-	-	-	-	65	351	68	64	-	-	-	548
	Georgia Strait	Obs:	-	-	-	-	-	-	136	48	27	2	-	-	213
		Est:	-	-	-	-	-	-	371	132	64	6	-	-	573
	Washington/Oregon	Obs:	-	-	-	-	-	-	11	15	-	-	-	-	26
		Est:	-	-	-	-	-	-	44	51	-	-	-	-	94
	Miscellaneous	Obs:	-	-	-	-	-	-	1	1	-	-	-	-	2
		Est:	-	-	-	-	-	-	4	4	-	-	-	-	8
Net	Central	Obs:	-	-	-	-	-	-	1	2	-	-	-	-	3
		Est:	-	-	-	-	-	-	9	5	-	-	-	-	13
	Southwest Vancouver Is.	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	3	-	-	-	-	-	3
	Johnstone Strait	Obs:	-	-	-	-	-	-	3	10	3	5	-	-	21
		Est:	-	-	-	-	-	-	6	20	7	12	-	-	45
	Juan de Fuca	Obs:	-	-	-	-	-	-	2	19	15	2	-	-	38
		Est:	-	-	-	-	-	-	3	27	53	12	-	-	95
	Georgia Strait	Obs:	-	-	-	-	-	-	-	2	-	-	-	-	2
		Est:	-	-	-	-	-	-	-	3	-	-	-	-	3
	Puget Sound	Obs:	-	-	-	-	-	-	1	14	64	84	1	-	164
		Est:	-	-	-	-	-	-	2	24	171	238	4	-	440
	Fraser River	Obs:	-	-	-	-	-	-	1	-	14	38	-	-	53
		Est:	-	-	-	-	-	-	1	-	34	103	-	-	138

continued

Appendix 3b. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 16 59).

Fishery	Location		1980 Catch by month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Total		Obs:	0	0	1	13	36	79	295	194	143	138	2	0	901
		Est:	0	0	4	52	144	216	1217	669	490	407	9	0	3207

Appendix 3b. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 16 59).

			1981 Catch by month											
Fishery	Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Total		Obs:	0	0	0	0	0	0	0	0	1	0	0	0	1
		Est:	0	0	0	0	0	0	0	0	4	0	0	0	4

Appendix 3c. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 18 23).

Fishery	Location		1980 Catch by month												Total
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	-	-	1	1	-	-	2
		Est:	-	-	-	-	-	-	-	-	2	2	-	-	4
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
Total		Obs:	0	0	0	0	0	0	0	0	3	1	0	0	4
		Est:	0	0	0	0	0	0	0	0	6	2	0	0	8

Appendix 3c. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 18 23).

Fishery	Location		1981 Catch by month												Total
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sport	Georgia Strait	Obs:	-	-	-	8	34	65	74	39	17	1	-	-	238
		Est:	-	-	-	37	86	240	319	170	68	4	-	-	924
	Puget Sound	Obs:	-	-	-	-	1	-	1	1	1	-	-	-	4
		Est:	-	-	-	-	6	-	1	5	6	-	-	-	18
	Washington/Oregon	Obs:	-	-	-	-	-	1	2	1	2	-	-	-	6
		Est:	-	-	-	-	-	3	6	6	4	-	-	-	19
	Freshwater	Obs:	-	-	-	-	-	-	-	-	-	1	-	-	1
		Est:	-	-	-	-	-	-	-	-	-	1	-	-	1
Troll	North Central	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	3	-	-	-	-	3
	South Central	Obs:	-	-	-	-	-	-	13	7	1	-	-	-	21
		Est:	-	-	-	-	-	-	67	45	2	-	-	-	113
	West Vancouver Island	Obs:	-	-	-	-	-	-	47	17	13	1	-	-	78
		Est:	-	-	-	-	-	-	378	157	150	1	-	-	686
	Georgia Strait	Obs:	-	-	-	-	-	-	52	6	4	-	-	-	62
		Est:	-	-	-	-	-	-	211	40	18	-	-	-	268
	Washington/Oregon	Obs:	-	-	-	-	-	-	19	15	-	-	-	-	34
		Est:	-	-	-	-	-	-	51	48	-	-	-	-	100
	Miscellaneous	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	5	-	-	-	-	5
Net	Southwest Vancouver Is.	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	1	-	-	-	-	-	-	1
	Johnstone Strait	Obs:	-	-	-	-	-	5	20	9	25	-	-	-	59
		Est:	-	-	-	-	-	9	40	72	101	-	-	-	222
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	6	16	-	-	-	22
		Est:	-	-	-	-	-	-	-	41	70	-	-	-	111
	Georgia Strait	Obs:	-	-	-	-	-	-	2	3	-	-	-	-	5
		Est:	-	-	-	-	-	-	3	14	-	-	-	-	17
	Puget Sound	Obs:	-	-	-	-	-	-	2	17	36	2	-	-	57
		Est:	-	-	-	-	-	-	3	31	149	7	-	-	189
Total		Obs:	0	0	0	8	35	72	232	123	115	5	0	0	590
		Est:	0	0	0	37	92	253	1079	637	568	13	0	0	2677

Appendix 3c. Observed and estimated recoveries of Salmon River (Langley) coho salmon (code 02 18 23).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Puget Sound	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	6	-	-	-	-	6
Total		Obs:	0	0	0	0	0	0	0	1	0	0	0	0	1
		Est:	0	0	0	0	0	0	0	6	0	0	0	0	6

Appendix 4a. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 16 60).

Fishery	Location		1981 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	1	4	6	5	4	6	3	-	-	-	29
		Est:	-	-	4	19	15	18	17	26	12	-	-	-	111
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	2	-	-	-	2
		Est:	-	-	-	-	-	-	-	-	11	-	-	-	11
	Washington/Oregon	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	3	-	-	-	-	-	3
Troll	South Central	Obs:	-	-	-	-	-	-	9	2	1	-	-	-	12
		Est:	-	-	-	-	-	-	40	19	1	-	-	-	60
	West Vancouver Island	Obs:	-	-	-	-	-	-	19	11	2	-	-	-	32
		Est:	-	-	-	-	-	-	153	102	2	-	-	-	257
	Georgia Strait	Obs:	-	-	-	-	-	-	8	5	-	-	-	-	13
		Est:	-	-	-	-	-	-	32	35	-	-	-	-	67
	Washington/Oregon	Obs:	-	-	-	-	-	-	6	3	-	-	-	-	9
		Est:	-	-	-	-	-	-	16	9	-	-	-	-	25
Net	Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	3	-	-	-	-	-	3
	Southwest Vancover Is.	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	1	-	-	-	-	1
	Johnstone Strait	Obs:	-	-	-	-	-	1	3	-	6	-	-	-	10
		Est:	-	-	-	-	-	2	11	-	24	-	-	-	37
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	1	9	-	-	-	10
		Est:	-	-	-	-	-	-	-	6	33	-	-	-	39
	Puget Sound	Obs:	-	-	-	-	-	-	-	5	16	1	-	-	22
		Est:	-	-	-	-	-	-	-	8	61	5	-	-	73
	Fraser River	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Total		Obs:	0	0	1	4	6	6	51	34	40	1	0	0	143
		Est:	0	0	4	19	15	20	275	206	148	5	0	0	691

Appendix 4a. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 16 60).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Troll	West Vancouver Island	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	6	-	-	-	-	-	6
Net	Puget Sound	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
Total		Obs:	0	0	0	0	0	0	1	0	1	0	0	0	2
		Est:	0	0	0	0	0	0	6	0	2	0	0	0	8

Appendix 4b. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 16 62).

Fishery	Location		1980 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	2	-	-	-	-	2
Total		Obs:	0	0	0	0	0	0	0	1	0	0	0	0	1
		Est:	0	0	0	0	0	0	0	2	0	0	0	0	2

Appendix 4b. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 16 62).

Fishery	Location		1981 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	1	-	2	7	11	10	4	2	-	-	-	37
		Est:	-	4	-	9	18	41	43	17	8	-	-	-	140
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	2	-	-	-	2
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
	Washington/Oregon	Obs:	-	-	-	-	-	1	-	2	-	-	-	-	3
		Est:	-	-	-	-	-	2	-	5	-	-	-	-	6
Troll	South Central	Obs:	-	-	-	-	-	-	5	4	1	-	-	-	10
		Est:	-	-	-	-	-	-	29	31	10	-	-	-	70
	West Vancouver Island	Obs:	-	-	-	-	-	-	32	15	11	-	-	-	58
		Est:	-	-	-	-	-	-	258	139	127	-	-	-	524
	Georgia Strait	Obs:	-	-	-	-	-	-	7	-	-	-	-	-	7
		Est:	-	-	-	-	-	-	34	-	-	-	-	-	34
	Washington/Oregon	Obs:	-	-	-	-	-	1	20	5	-	-	-	-	26
		Est:	-	-	-	-	-	1	55	24	-	-	-	-	81
	Miscellaneous	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	5	-	-	-	-	5
Net	Southwest Vancouver Is.	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	1	-	-	-	-	-	-	1
	Johnstone Strait	Obs:	-	-	-	-	-	-	1	3	8	-	-	-	12
		Est:	-	-	-	-	-	-	2	21	30	-	-	-	53
	Juan de Fuca	Obs:	-	-	-	-	-	-	3	6	20	-	-	-	29
		Est:	-	-	-	-	-	-	11	38	88	-	-	-	137
	Georgia Strait	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	1	-	-	-	-	-	1
	Puget Sound	Obs:	-	-	-	-	-	-	2	4	23	1	-	-	30
		Est:	-	-	-	-	-	-	3	7	93	5	-	-	108
Total		Obs:	0	1	0	2	7	14	81	44	67	1	0	0	217
		Est:	0	4	0	9	18	45	436	287	358	5	0	0	1162

Appendix 4b. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 16 62).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	1	-	2	1	2	3	-	-	-	-	9
		Est:	-	-	4	-	7	2	7	11	-	-	-	-	31
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	2	-	-	-	2
		Est:	-	-	-	-	-	-	-	-	12	-	-	-	12
Troll	South Central	Obs:	-	-	-	-	-	-	2	-	-	-	-	-	2
		Est:	-	-	-	-	-	-	7	-	-	-	-	-	7
	West Vancouver Island	Obs:	-	-	-	-	-	-	14	2	1	-	-	-	17
		Est:	-	-	-	-	-	-	86	16	8	-	-	-	110
	Georgia Strait	Obs:	-	-	-	-	-	-	5	-	-	-	-	-	5
		Est:	-	-	-	-	-	-	24	-	-	-	-	-	24
	Washington/Oregon	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	5	-	-	-	-	-	5
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	2	1	3	2	-	-	8
		Est:	-	-	-	-	-	-	3	6	11	9	-	-	30
	Puget Sound	Obs:	-	-	-	-	-	-	1	-	3	2	-	-	6
		Est:	-	-	-	-	-	-	1	-	9	5	-	-	14
	Fraser River	Obs:	-	-	-	-	-	-	-	-	-	2	-	-	2
		Est:	-	-	-	-	-	-	-	-	-	9	-	-	9
Total		Obs:	0	0	1	0	2	1	27	6	9	6	0	0	52
		Est:	0	0	4	0	7	2	133	33	40	23	0	0	242

Appendix 4c. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 18 02).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	3	9	6	6	4	-	-	-	28
		Est:	-	-	-	-	11	14	22	22	9	-	-	-	78
	Central	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	1	-	-	-	-	1
	Puget Sound	Obs:	-	-	-	-	-	-	-	3	-	-	-	-	3
		Est:	-	-	-	-	-	-	-	18	-	-	-	-	18
	Washington/Oregon	Obs:	-	-	-	-	-	2	-	-	-	-	-	-	2
		Est:	-	-	-	-	-	4	-	-	-	-	-	-	4
Troll	South Central	Obs:	-	-	-	-	-	-	2	-	2	-	-	-	4
		Est:	-	-	-	-	-	-	12	-	13	-	-	-	25
	West Vancouver Island	Obs:	-	-	-	-	-	-	19	7	5	-	-	-	31
		Est:	-	-	-	-	-	-	116	56	38	-	-	-	210
	Georgia Strait	Obs:	-	-	-	-	-	-	9	3	-	-	-	-	12
		Est:	-	-	-	-	-	-	36	18	-	-	-	-	54
	Washington/Oregon	Obs:	-	-	-	-	-	3	7	1	1	-	-	-	12
		Est:	-	-	-	-	-	5	22	1	2	-	-	-	30
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	2	2	4	2	-	-	10
		Est:	-	-	-	-	-	-	3	8	13	9	-	-	33
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	2	5	-	-	-	7
		Est:	-	-	-	-	-	-	-	8	28	-	-	-	36
	Puget Sound	Obs:	-	-	-	-	-	-	1	1	11	2	-	-	15
		Est:	-	-	-	-	-	-	1	3	29	3	-	-	36
Total		Obs:	0	0	0	0	3	14	46	26	32	4	0	0	125
		Est:	0	0	0	0	11	23	212	135	132	12	0	0	525

Appendix 4d. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 18 03).

Fishery	Location		1981 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	2	-	-	-	-	-	2
Total		Obs:	0	0	0	0	0	0	1	0	0	0	0	0	1
		Est:	0	0	0	0	0	0	2	0	0	0	0	0	2

Appendix 4d. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 18 03).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	1	2	6	7	10	11	2	1	-	-	40
		Est:	-	-	4	8	21	11	37	40	4	2	-	-	128
	Puget Sound	Obs:	-	-	-	-	-	-	-	2	-	-	-	-	2
		Est:	-	-	-	-	-	-	-	11	-	-	-	-	11
	Washington/Oregon	Obs:	-	-	-	-	-	-	1	3	2	-	-	-	6
		Est:	-	-	-	-	-	-	1	11	7	-	-	-	19
Troll	North Central	Obs:	-	-	-	-	-	-	1	1	1	-	-	-	3
		Est:	-	-	-	-	-	-	3	2	3	-	-	-	8
	South Central	Obs:	-	-	-	-	-	-	7	1	1	-	-	-	9
		Est:	-	-	-	-	-	-	34	4	4	-	-	-	42
	West Vancouver Island	Obs:	-	-	-	-	-	-	53	15	10	-	-	-	78
		Est:	-	-	-	-	-	-	324	119	77	-	-	-	520
	Georgia Strait	Obs:	-	-	-	-	-	-	11	2	1	-	-	-	14
		Est:	-	-	-	-	-	-	46	9	6	-	-	-	60
	Washington/Oregon	Obs:	-	-	-	-	-	6	17	2	5	-	-	-	30
		Est:	-	-	-	-	-	11	56	2	10	-	-	-	79
	Miscellaneous	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	6	-	-	-	-	-	6
Net	Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	2	-	-	-	-	-	2
	Johnstone Strait	Obs:	-	-	-	-	-	-	4	3	4	2	-	-	13
		Est:	-	-	-	-	-	-	10	12	13	9	-	-	44
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	2	5	-	-	-	7
		Est:	-	-	-	-	-	-	-	8	28	-	-	-	36
	Puget Sound	Obs:	-	-	-	-	-	-	-	10	28	12	-	-	50
		Est:	-	-	-	-	-	-	-	29	68	39	-	-	137
	Fraser River	Obs:	-	-	-	-	-	-	-	-	-	10	-	-	10
		Est:	-	-	-	-	-	-	-	-	-	48	-	-	48
Total		Obs:	0	0	1	2	6	13	106	52	59	25	0	0	264
		Est:	0	0	4	8	21	22	519	247	220	98	0	0	1140

Appendix 4d. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 18 03).

Fishery	Location		1983 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	1	2	5	3	2	1	1	-	-	15
		Est:	-	-	-	4	6	16	8	6	3	4	-	-	48
	Washington/Oregon	Obs:	-	-	-	-	-	-	-	2	-	-	-	-	2
		Est:	-	-	-	-	-	-	-	4	-	-	-	-	4
Troll	Northern	Obs:	-	-	-	-	-	-	-	-	-	1	-	-	1
		Est:	-	-	-	-	-	-	-	-	-	3	-	-	3
	North Central	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	7	-	-	-	-	7
	South Central	Obs:	-	-	-	-	-	-	4	-	-	-	-	-	4
		Est:	-	-	-	-	-	-	29	-	-	-	-	-	29
	West Vancouver Island	Obs:	-	-	-	-	-	-	14	3	2	1	-	-	20
		Est:	-	-	-	-	-	-	112	23	10	5	-	-	150
	Georgia Strait	Obs:	-	-	-	-	-	-	-	-	-	1	-	-	1
		Est:	-	-	-	-	-	-	-	-	-	10	-	-	10
Net	Central	Obs:	-	-	-	-	-	-	-	2	-	-	-	-	2
		Est:	-	-	-	-	-	-	-	7	-	-	-	-	7
	Johnstone Strait	Obs:	-	-	-	-	-	-	-	-	2	-	-	-	2
		Est:	-	-	-	-	-	-	-	-	9	-	-	-	9
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	5	4	-	-	9
		Est:	-	-	-	-	-	-	-	-	22	6	-	-	28
	Fraser River	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Total		Obs:	0	0	0	1	2	5	21	10	12	8	0	0	59
		Est:	0	0	0	4	6	16	149	47	50	28	0	0	301

Appendix 4d. Observed and estimated recoveries of Upper Pitt River coho salmon (code 02 18 03).

			1984 Catch by month											
Fishery	Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Net	Central	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Total		Obs:	0	0	0	0	0	0	0	0	1	0	0	0	1
		Est:	0	0	0	0	0	0	0	0	4	0	0	0	4

Appendix 5a. Observed and estimated recoveries of Birkenhead River coho salmon (code 02 22 09).

Fishery	Location		1984 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	2	1	10	8	1	-	-	-	-	22
		Est:	-	-	-	5	3	33	25	5	-	-	-	-	72
	Puget Sound	Obs:	-	-	-	-	-	1	-	-	-	-	-	-	1
		Est:	-	-	-	-	-	4	-	-	-	-	-	-	4
	Washington/Oregon	Obs:	-	-	-	-	-	-	6	5	-	-	-	-	11
		Est:	-	-	-	-	-	-	15	11	-	-	-	-	25
	Freshwater	Obs:	-	-	-	-	1	-	-	-	-	1	-	-	2
		Est:	-	-	-	-	1	-	-	-	-	1	-	-	2
Troll	South Central	Obs:	-	-	-	-	-	-	-	2	1	-	-	-	3
		Est:	-	-	-	-	-	-	-	12	4	-	-	-	16
	West Vancouver Island	Obs:	-	-	-	-	-	-	74	45	38	-	-	-	157
		Est:	-	-	-	-	-	-	380	288	169	-	-	-	837
	Georgia Strait	Obs:	-	-	-	-	-	-	3	1	-	-	-	-	4
		Est:	-	-	-	-	-	-	16	2	-	-	-	-	18
	Washington/Oregon	Obs:	-	-	-	-	-	-	-	2	-	-	-	-	2
		Est:	-	-	-	-	-	-	-	16	-	-	-	-	16
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	-	1	1	-	-	-	2
		Est:	-	-	-	-	-	-	-	7	3	-	-	-	9
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	9	-	-	-	-	9
		Est:	-	-	-	-	-	-	-	31	-	-	-	-	31
	Puget Sound	Obs:	-	-	-	-	-	-	3	4	2	5	-	-	14
		Est:	-	-	-	-	-	-	4	4	4	11	-	-	23
	Fraser River	Obs:	-	-	-	-	-	-	-	-	3	-	-	-	3
		Est:	-	-	-	-	-	-	-	-	6	-	-	-	6
Total		Obs:	0	0	0	2	2	11	94	70	45	6	0	0	230
		Est:	0	0	0	5	4	37	440	376	186	12	0	0	1059

Appendix 5a. Observed and estimated recoveries of Birkenhead River coho salmon (code 02 22 09).

Fishery	Location		1985 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	1	-	1	-	-	-	-	-	-	2
		Est:	-	-	-	4	-	3	-	-	-	-	-	-	7
	Puget Sound	Obs:	-	-	-	-	-	-	1	1	1	-	-	-	3
		Est:	-	-	-	-	-	-	5	5	2	-	-	-	11
	Washington/Oregon	Obs:	-	-	-	-	-	-	2	-	-	-	-	-	2
		Est:	-	-	-	-	-	-	3	-	-	-	-	-	3
Troll	West Vancouver Island	Obs:	-	-	-	-	-	-	3	3	2	-	-	-	8
		Est:	-	-	-	-	-	-	16	16	8	-	-	-	40
	Washington/Oregon	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	4	-	-	-	-	-	4
Net	Juan de Fuca	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	4	-	-	-	-	4
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	2	1	-	-	3
		Est:	-	-	-	-	-	-	-	-	2	3	-	-	5
	Fraser River	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
Total		Obs:	0	0	0	1	0	1	7	5	6	1	0	0	21
		Est:	0	0	0	4	0	3	28	25	14	3	0	0	76

Appendix 5b. Observed and estimated recoveries of Birkenhead River coho salmon (code 02 23 26).

Fishery	Location		1984 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	1	-	3	-	-	-	-	-	-	4
		Est:	-	-	-	3	-	10	-	-	-	-	-	-	13
	Puget Sound	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	4	-	-	-	4
Troll	West Vancouver Island	Obs:	-	-	-	-	-	-	7	3	4	-	-	-	14
		Est:	-	-	-	-	-	-	36	19	18	-	-	-	73
Net	Johnstone Strait	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	2	-	-	-	-	-	2
	Puget Sound	Obs:	-	-	-	-	-	-	1	1	-	-	-	-	2
		Est:	-	-	-	-	-	-	1	4	-	-	-	-	5
Total		Obs:	0	0	0	1	0	3	9	4	5	0	0	0	22
		Est:	0	0	0	3	0	10	39	23	22	0	0	0	97

Appendix 6a. Observed and estimated recoveries of Little Campbell River coho salmon (code 02 22 62).

Fishery	Location		1982 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sport	Georgia Strait	Obs:	-	-	-	-	-	-	-	-	1	-	-	-	1
		Est:	-	-	-	-	-	-	-	-	2	-	-	-	2
	Freshwater	Obs:	-	-	-	-	-	-	-	-	-	4	-	-	4
		Est:	-	-	-	-	-	-	-	-	-	4	-	-	4
Net	Puget Sound	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	1	-	-	-	-	1
Total		Obs:	0	0	0	0	0	0	0	1	1	4	0	0	6
		Est:	0	0	0	0	0	0	0	1	2	4	0	0	7

Appendix 6a. Observed and estimated recoveries of Little Campbell River coho salmon (code 02 22 62).

Fishery	Location		1983 Catch by month												Total
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Sport	Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	1	-	-	-	-	-	1
	Georgia Strait	Obs:	1	-	2	3	12	39	23	22	9	3	-	-	114
		Est:	1	-	4	12	37	125	64	67	30	13	-	-	353
	Puget Sound	Obs:	-	-	-	-	-	1	2	2	2	-	-	-	7
		Est:	-	-	-	-	-	5	13	14	13	-	-	-	45
	Washington/Oregon	Obs:	-	-	-	-	-	-	3	4	-	-	-	-	7
		Est:	-	-	-	-	-	-	6	9	-	-	-	-	15
	Freshwater	Obs:	-	-	-	-	-	-	-	-	-	-	1	-	1
		Est:	-	-	-	-	-	-	-	-	-	-	1	-	1
Troll	Southeast Alaska	Obs:	-	-	-	-	-	-	2	-	-	-	-	-	2
		Est:	-	-	-	-	-	-	3	-	-	-	-	-	3
	Northern	Obs:	-	-	-	-	-	-	1	1	-	-	-	-	2
		Est:	-	-	-	-	-	-	6	9	-	-	-	-	15
	North Central	Obs:	-	-	-	-	-	-	2	-	-	-	-	-	2
		Est:	-	-	-	-	-	-	10	-	-	-	-	-	10
	South Central	Obs:	-	-	-	-	-	-	5	6	3	1	-	-	15
		Est:	-	-	-	-	-	-	36	39	19	6	-	-	100
	West Vancouver Island	Obs:	-	-	-	-	-	-	59	18	15	2	-	-	94
		Est:	-	-	-	-	-	-	474	136	74	9	-	-	693
	Georgia Strait	Obs:	-	-	-	-	-	-	2	-	-	1	-	-	3
		Est:	-	-	-	-	-	-	2	-	-	10	-	-	12
	Washington/Oregon	Obs:	-	-	-	-	-	-	1	2	2	-	-	-	5
		Est:	-	-	-	-	-	-	3	5	3	-	-	-	11
	Miscellaneous	Obs:	-	-	-	-	-	-	2	-	-	-	-	-	2
		Est:	-	-	-	-	-	-	12	-	-	-	-	-	12
Net	Northern	Obs:	-	-	-	-	-	-	-	1	-	-	-	-	1
		Est:	-	-	-	-	-	-	-	5	-	-	-	-	5
	Central	Obs:	-	-	-	-	-	-	1	-	-	-	-	-	1
		Est:	-	-	-	-	-	-	6	-	-	-	-	-	6
	Johnstone Strait	Obs:	-	-	-	-	-	-	4	9	13	-	-	-	26
		Est:	-	-	-	-	-	-	17	43	67	-	-	-	127

continued

Appendix 6a. Observed and estimated recoveries of Little Campbell River coho salmon (code 02 22 62).

Fishery	Location		1983 Catch by month												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	Juan de Fuca	Obs:	-	-	-	-	-	-	-	-	3	-	-	-	3
		Est:	-	-	-	-	-	-	-	-	6	-	-	-	6
	Puget Sound	Obs:	-	-	-	-	-	-	8	25	27	4	-	-	64
		Est:	-	-	-	-	-	-	14	55	72	16	-	-	156
	Fraser River	Obs:	-	-	-	-	-	-	-	-	6	-	-	-	6
		Est:	-	-	-	-	-	-	-	-	19	-	-	-	19
Total		Obs:	1	0	2	3	12	40	116	90	80	11	1	0	356
		Est:	1	0	4	12	37	130	667	382	303	54	1	0	1590